BOOSTING PUBLIC CONSTRUCTION PROJECT OUTCOMES THROUGH RELATIONAL TRANSACTIONS IN SINGAPORE

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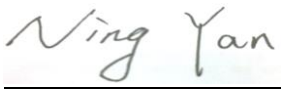
DECLARATION

I hereby declare that the thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.



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SUMMARY

Past studies have found that relational transactions (*i.e.*, relational contract norms and network strategies) have a positive relationship with project outcomes. These empirical studies, however, mainly investigated projects in general, without differentiating project types (*i.e.*, whether public or private projects). In reality, the scenario faced by contracting parties in public projects may differ from that in private projects because close relationships between public officials and private consultants/contractors may lead to allegations of corruption. Hitherto, the research on relational transactions in public projects is still piecemeal and anecdotal. Drawing upon the Relational Contracts theory and the theory of Network Embeddedness, this study investigated: the relational transaction practices leading to better performance; and the drivers of and barriers to relational transactions in public projects.

A two-pronged research design was undertaken in Singapore. A questionnaire-survey of 104 public projects was initially conducted. After the data were collected, the one sample *t* test and factor analysis were used to derive the critical barriers and drivers; the unpaired *t* test was applied to compare different parties' perception of the drivers and barriers; and Partial Least Squares-Structural Equation Modeling (PLS-SEM) was used to identify the critical relational transaction practices that lead to better project outcomes. The main statistical results obtained were thereafter validated by the qualitative information gathered from the second prong of eight interviews.

The results showed that information sharing gives rise to better relationships; good relationships further contribute significantly to time performance and satisfaction, indicating that public projects can benefit from good relationships. The results also found that public projects benefit from relational transactions as well. The main findings are: (i) propriety of means contributes significantly to cost performance; (ii)

flexibility and contractual solidarity have a significant impact on time performance; and (iii) harmonization within the social matrix and propriety of means allow for a significantly higher level of satisfaction.

The results also revealed that the adoption of relational transactions in public projects is significantly motivated by 21 drivers but deterred by 15 barriers. Three factors were further derived from the 21 drivers, which are: (i) increasing value proposition; (ii) improving business competitiveness; and (iii) improving project time and cost performance. The 15 barriers were further categorized into four factors. These are: (i) lack of capabilities; (ii) ethos of public services; (iii) lack of continuity; and (iv) institutional constraints. The comparison results showed that: (i) contracting parties' perception of the drivers is not significantly different; (ii) the biggest challenge to adopting relational transactions stems from the public sector client, followed by the consultants; and (iii) contractors face the least number of barriers.

This study contributes to the knowledge of public project management by showing that both the theory of Network Embeddedness and the Relational Contracts theory are applicable to public construction projects. Critical relational transactions, as well as the critical drivers of and barriers to relational transactions, are thus highlighted to contracting parties in public projects so that they can adopt these to improve their project outcomes.

Key words:
relational contracts; network embeddedness; public projects; Singapore; outcomes

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List of Abbreviations

AVE: Average Variance Extracted

BCA: Building and Construction Authority

CL: Clients

CR: Composite reliability

CRS: Contractors Registry System

CS: Consultants

CT: Contractors

EFA: Exploratory Factor Analysis

FL: Flexibility

GeBIZ: Government Electronic Business

GLCs: Government linked companies

GOCs: Government owned companies

HDB: Housing and Development Board

HM: Harmonization within the social matrix

IS: Information sharing

JTC: Jurong Town Corporation

KMO: Kaiser–Meyer–Olkin

LTA: Land Transport Authority

MCAR: Missing Completely at Random

MOF: Ministry of Finance

PLS-SEM: Partial Least Squares-Structural Equation Modeling

PQM: Price-Quality Method

PR: Propriety of means

PS: Joint problem solving

PSPC: Public Sector Panels of Consultants

PSSCOC: Public Sector Standard Conditions of Contract

QFM: Quality-Fee selection Method

RC: Relational Contracting

RI: Role integrity

SO: Contractual solidarity

TR: Trust

Chapter 1 Introduction

1.1 Background

Singapore's construction sector is plagued by poor cost and time performance (Ling, 2004; Ling and Kerh, 2004) as well as a major problem of low productivity and negative productivity growth (Construction 21 Steering Committee, 1999). According to the Economic Strategies Committee (2010), the productivity level of Singapore's construction sector is only half that of the United States and one-third that of Japan.

Past studies have found that poor project performance may be attributed to adversarial relationships among contracting parties (*e.g.*, Cook and Hancher, 1990; Dainty *et al.*, 2001; Ng *et al.*, 2002; Eriksson and Laan, 2007). The relationships among contracting parties may become adversarial for the following reasons: (i) clients focus too much on price and authority, and too little on trust (Eriksson and Laan, 2007); (ii) a purely price-dominated selection criterion entices tenderers to lower their bids in order to win contracts, relying on subsequent claims to recover their costs (Rahman and Kumaraswamy, 2004b); and (iii) firms work mainly on a project-by-project basis, which is detrimental to long-term relationships (Chan *et al.*, 2008).

Adversarial relationships and their causes may be due to the heavy reliance on formal contracts and may be explained by the Rational Choice theory (Becker, 1976). Since using formal contracts highlights the rights, responsibilities and liabilities of the contracting parties which are spelt out in legal documents, contracting parties would make sure they protect and enforce their rights, and try to minimize their liabilities (Williamson, 1975). Participation of the contracting parties in an economic exchange would feature "sharp in" and "sharp out" (Macneil, 1978). These would lead parties to act in an "atomized" manner (Williamson, 1975).

In reality, aside from formal contractual relationships, contracting parties also have relational links with each other. The formal contract is thus complemented by relational contracts (Macneil, 1983; 1985), in which contracting parties adopt relational contracting (RC) behavior and practices. In contrast to Becker's (1976) Rational Choice theory, Macneil's (1983) theory of Relational Contracts states that informal agreements and unwritten codes of conduct exist between contracting partners, and these are sustained by the value of future relationships (Macneil, 1978). An important attribute of relational contracts is that the relationship of exchange continues over a significant period of time (Bird, 2005). Over time, "exchanges made with long-run motivations produce norms to which the participants expect to adhere to and to which they expect adherence from other parties" (Macneil, 1986a:578-579). Prior empirical studies have found that RC practices could bring about superb project outcomes (*e.g.*, Rahman and Kumaraswamy, 2004a; Ling *et al.*, 2006).

Besides the ongoing relationships (formal and relational) that are present in a particular project, contracting parties may have past or possible future relationships. These are present because firms are embedded in a network. This may be explained by Granovetter's (1985) Network Embeddedness theory which states that economic behaviors are embedded in a larger social context. Inter-firm networks operate on a logic of exchange that is different from both the logic of markets and hierarchies (Sydow and Windeler, 1998). In the construction context, past empirical studies have also found that the degree of embedded networks influences both company and project performance (*e.g.*, Chinowsky *et al.*, 2008; 2010; EI-Sheikh and Pryke, 2010; Chowdhury *et al.*, 2011; Ling and Li, 2012).

1.2 Research Questions

The above brief review shows that relational transactions (*i.e.*, RC practices and network strategies) have a positive association with project outcomes (Chinowsky *et al.*, 2008; Ling and Li, 2012; Rahman and Kumaraswamy, 2012) and the network of social relationships which embeds contracting parties has an impact on their behaviors in economic exchanges (Granovetter, 1985). However, contracting parties in public projects face more constraints in adopting relational transactions as public clients cannot be seen to have a "hand-in-glove" relationship with private parties, which may imply cronyism, and the widespread practice of open tenders makes the possibility of future relationships remote. Therefore, the first research question that is addressed is:

> "*Can public projects benefit from relational transactions and good relationships among contracting parties?*" *(RQ1)*

The answer to this question is important as it will inform contracting parties that besides formal controlling methods, relational transactions may also be a possible strategy to improve project outcomes.

Besides eschewing close relationships, it is also possible that contracting parties are unable to correctly make use of relational transactions, thereby forcing them to revert to the more traditional routines (Akintoye *et al.*, 2000; Glagola and Sheedy, 2002). One possible way to resolve this shortfall is for contracting parties to shed more light on the relational transaction practices that can lead to better performance (Ling *et al.*, 2006; Ling and Tran, 2012). Hence, the second research question is:

> "*To what extent can relational transactions contribute to better public project outcomes?*" *(RQ2)*

The identification of relational transaction practices that lead to better outcomes will provide contracting parties a framework to implement such transactions in public projects.

The other problem is that with firms existing in the same network, past and future relationships would affect how they behave in current relationships (Granovetter, 1985). However, the widespread practice of open tenders to procure services and products in public projects puts high priority to bidders' merit, capability and tendering price rather than on previous partnerships. With open tenders called for most public projects, public clients generally cannot promise existing private partners future projects. This suggests no guarantee of future relationships, even when partners are embedded within the same network. This potential discontinuity in relationships would cause partners to act in an atomized manner, which impedes relationship development. This leads to the third research question:

> *"Which are the relational transaction practices that can help to establish good relationships in public projects?" (RQ3)?*

The recognition of the determinants of good relationships would offer contracting parties the strategies to harmonize their relationships in public projects. Improved relationships would then possibly allow for better project outcomes.

Although relational transactions have a positive association with project outcomes (*e.g.*, Rahman and Kumaraswamy, 2012; Chinowsky *et al.*, 2008; 2010; Taylor *et al.*, 2010; Ling and Li, 2012) and they are also attractive to public agencies in improving project performance (*e.g.*, Chan *et al.*, 2001a; Rahman and Kumaraswamy, 2004b; Dewulf *et al.*, 2012), not all contracting parties are willing to adopt relational transactions. This may be attributed to a series of barriers (*e.g.*, Humphreys *et al.*, 2003; Ling *et al.*, 2006) or the fact that contracting parties are not substantially driven

by the benefit of changing the status quo (Phua, 2006). There is therefore a need to identify:

> *"Which are the factors that will significantly motivate or inhibit relational transaction practices in public projects?" (RQ4)*

It is important to identify the drivers of and barriers to relational transactions in public projects. A clear understanding of the drivers can help contracting parties to customize their relational transactions in order to reap the expected benefits. An awareness of the barriers would enable them to understand the challenges, and thereafter help them to take steps to minimize their negative impacts.

Despite increasing expectations, the public sector faces more constraints in its attempt to adopt relational transactions because of rigid and impermeable organizational boundaries within government agencies (*e.g.*, Crowley and Karim, 1995; Chan *et al.*, 2001; Rahman and Kumaraswamy, 2004b). The preset regulations, for instance, restrict public officials in some activities, making them perpetuate behavioral patterns that go against collaborative relationships (Rahman and Kumaraswamy, 2004b). By contrast, private parties' boundaries are more flexible and permeable, making it an ideal climate for close inter-organizational cooperation in relational transactions (Rahman and Kumaraswamy, 2004b). This indicates that parties in public projects may have different perceptions of the factors motivating and deterring relational transaction practices. It leads to the next research question that needs to be addressed:

> *"Do contracting parties have significantly different perceptions of the factors motivating and deterring relational transactions in public projects?" (RQ5)*

Understanding the differences in the contracting parties' perception of the drivers of and barriers to relational transactions can help each party to craft suitable relational transactions to improve relationships among contracting parties. Contracting parties will also be aware of what their partners' concerns are so they will avoid any action

that will cause the latter any concern. A good understanding of the motivating and deterring factors of relational transactions in public projects will also help the various contracting parties to fashion the appropriate approaches to meet their partners' requirements should they adopt any relational transactions.

1.3 Research Objectives

The main aim of this research is to investigate relational transactions (*i.e.,* RC practices and network strategies) that would improve public project outcomes in Singapore. Under this aim, the specific objectives are to:

i. identify the drivers of and the barriers to adopting relational transactions in public projects;
ii. compare different parties' perceptions of the factors motivating and deterring relational transactions in public projects;
iii. examine whether relationship quality could give rise to better project outcomes; and
iv. explore to what extent relational transaction practices can lead to better outcomes and relationship quality (*i.e.,* if they have an impact on outcomes and relationship quality).

This research is significant because the findings could inform contracting parties that besides formal controls, relational transactions may also be a possible strategy to improve public project outcomes. The identification of relational transaction practices that lead to better outcomes provides parties a framework to implement such transactions in public projects. A good understanding of the drivers of and barriers to relational transactions helps contracting parties to fashion appropriate approaches to meet their partners' requirements should they adopt any relational transactions. In addition, understanding the differences in the contracting parties' perception of the

drivers of and barriers to relational transactions can help each party to craft suitable relational transactions to improve relationships among contracting parties.

1.4 Research Scope

This study focuses on relational transactions among public clients, private sector consultants and contractors involved in public construction projects in Singapore. Subcontractors are not included because: they do not interact with public clients directly; and the relational transactions between subcontractors and main contractors have been investigated (*e.g.*, Kumaraswamy and Mattews, 2000; Zou and Lim, 2006; Unsal and Taylor, 2011).

Public projects funded by the government (using taxpayers' money) are targeted because relational transactions undertaken by contracting parties in public projects may differ from those in general projects. Public clients usually procure services and products through competitive tendering which may indicate a discontinuity of relationships. Besides, the public sector cannot be seen to have close relationships with private parties as this would imply cronyism. Yet, building embedded networks is the core of relational transactions. Hitherto, there is little information about relational transactions in public construction projects (Ling and Tran, 2012; Dewulf *et al.*, 2012). Therefore, it is worthwhile to extend the current framework of relational transactions into the public sector.

In this study, a public sector project refers to projects owned by the public sector. The Building and Construction Authority's (BCA) (2008) definition of public sector is adopted, *i.e.*, the owner or client of the project is the government or a statutory board. Specifically, public sector clients comprise ministries, departments, statutory boards, government-linked companies (GLCs) and government-owned companies (GOCs).

Main public sector bodies function as clients of the construction industry, such as the Housing and Development Board (HDB), Land Transport Authority (LTA) and Jurong Town Corporation (JTC).

1.5 Structure of the Thesis

The structure of this thesis is organized as follows. After this introduction, Chapter 2 delivers a literature review of the theories underpinning relational transactions. Based on the literature review of the theory of Relational Contracts and the theory of Network Embeddedness, five RC norms and three network strategies are operationalized in the construction context.

Chapter 3 presents a conceptual framework for boosting public project outcomes through relational transactions. It is followed by a review of the practices of RC norms and network strategies, the drivers of and barriers to relational transactions. Based on the conceptual framework and the literature review, the gaps in knowledge are identified and thereafter the hypotheses are proposed.

Chapter 4 reports on the research methods. A two-pronged research design was applied. A questionnaire-survey was first adopted to collect quantitative data. In order to validate the statistical results from the questionnaire-survey, semi-structured interviews were second conducted. Associated data collection methods and data analysis techniques are also reported.

Chapter 5 reports the profiles of surveyed projects, respondents and their firms. Chapter 6 describes one part of the questionnaire-survey results pertaining to the drivers of and barriers to relational transaction practices. The one-sample *t* test and the Exploratory Factor Analysis (EFA) were used to identify the critical drivers of

and barriers to relational transactions. The unpaired *t* test was adopted to compare different parties' ratings of the drivers and barriers.

Chapter 7 presents the other part of the questionnaire-survey results regarding the identification of critical relational transaction practices that lead to better relationship quality and outcomes. Partial Least Squares-Structural Equation Modeling (PLS-SEM) was adopted at this stage. The statistical model obtained was validated through the qualitative data collected from the interviews.

Chapter 8 reports the conclusion of the study. Specifically, it consists of the summary of this study, key results, recommendations for practices, contributions to knowledge and practices, limitations of the study and recommendations for future studies.

Chapter 2 Literature Review of Relational Transactions

2.1 Introduction

This chapter reviews the theories underpinning relational transactions namely the Relational Contracts theory (see Section 2.3) and the theory of Network Embeddedness (see Section 2.4), which is more suitable for explaining transactions. By contrast, the Rational Choice theory has limitations in explaining all behaviors in transactions in reality (see Section 2.2).

2.2 Theory of Rational Choice

Formal contracts contain fairly explicit stipulations of proscribed and prescribed behaviors and risk allocation, representing promises or obligations to perform particular actions in the future (Macneil, 1978). They can be explained by the Rational Choice theory (Becker, 1976).

The Rational Choice theory assumes that: (i) interests of each party are known (Becker, 1976); (ii) parties know perfectly all the complete information (Machina, 1987); (iii) parties engage in transactions with minimum interdependence and little expectation for future interactions (Williamson, 1975); and (iv) the assumption of rationality can be applied with or without taking transaction costs into account, sweeping away all relations excepts pure competition with the broom of ceteris paribus (*i.e*., other things being equal) (Macneil, 2000b).

Decision makers under such circumstances are highly sensitive to the revenues, costs, likelihoods associated with different courses of actions and the opportunity cost associated with a given investment (Bottom *et al.*, 2006). They would thus pursue their interests rationally (Becker, 1976) and try to maximize utility (*i.e*. choosing the

preferred alternative) (Becker and Mruphy, 1988). They would resort to institutional arrangements and formal contracts to guard against troubles, ignoring the identity of and past relationships with individual actors.

The assumptions and application of the Rational Choice theory, however, have received many criticisms. The basic assumptions of expected utility maximisation under conditions of uncertainty are especially problematic (*e.g.*, Machina, 1987; Simon, 1987). Some also questioned whether decision makers have complete information about choice alternatives and are able to make the extensive computations (Simon, 1987). Aside from formal contractual relationships, contracting parties also have relational links (Macneil, 1983; Granovetter, 1985). These realities make the Rational Choice theory inadequate in explaining all behaviors in transactions.

2.3 Relational Contracts Theory

Relational contracts refer to informal agreements sustained by the value of future relationships (Baker *et al.* 2002). It signifies a commitment to cooperate in depth than a mere bargain for the allocation of risk (Bird, 2005). An important attribute of relational contracts is that the relationship of exchange continues over a significant period of time (Bird, 2005).

2.3.1 Incomplete contract approach and norm-based approach

Within the relational contract school of thoughts, two theories are pervasive Williamson's (1985) incomplete contract approach and (ii) Macneil's (2000a; b) norms-based approach (Blois, 2002). According to Williamson (2000), due to bounded rationality, contracts are usually incomplete. Contractual incompleteness

would pose added problems when it is paired with the presence of opportunism (Williamson, 2000).

To resolve this problem, choice of governance structures is one important lesson (Williamson, 2003). The adoption of forms of organizations depends on the properties of three dimensions of the transaction (Williamson, 1979; Macher and Richman, 2008), namely uncertainty, the frequency with which transactions recur; and the degree to which durable transaction-specific investments are incurred (Williamson, 1979). Increased asset specificity and uncertainty indicate a stronger demand for cooperative adaptation (Williamson, 2003). If these two attributes exist in recurrent exchanges, relational contracts would be a suitable choice for the governance mechanism (Williamson, 1979).

Unlike incomplete contracts, Macneil's (1983) norm-based approach starts the analysis from four primal roots of contracts: (i) specialization and exchange; (ii) sense of choice; (iii) conscious awareness of past, present and future; and (iv) the social matrix. This is one distinction. Under this background, contracts are not treated as synonymous with exchanges themselves, nor are contracts used to refer to a written agreement (Macaulay, 1963). But, they are referred to as "relations among people who have exchanged, are exchanging, or expect to be exchanging in the future, in other words, exchange relations rather than as specific transactions, specific agreements, specific promises, specific exchanges and the like" (Macneil, 2000b:878). Relations here encompass all relations in which exchanges take place (Macneil, 2000b).

Contracts in this definition are fundamentally about cooperative behaviors, encompassing all human activities where economic exchange is only one perspective (Macneil, 1985; Feinman, 2000). Besides the defined monetizable exchange,

contracts include other interactions (Feinman, 2000), like maintaining relationships, sharing experiences and communicating about issues in the industry (Bird, 2005).

Another distinction of Macneil's Relational Contracts theory is the norm-based analytical framework. Macneil (2000b) viewed a transaction as lying on a spectrum ranging from as-if-discrete norms through common contractual norms to relational (or intertwined) norms (see Figure 2.1). These three types of norms constitute an abstract summary of the varied and specific norms in myriad varieties of contracts (Macneil, 1980; Macneil, 1983). Norms here refer to "the behavior that does occur in relations, must occur if relations are to continue, and hence ought to occur so long as their continuance is valued" (Macneil, 1980:64). Macneil labeled this approach as the Essential Contracts theory (Macneil, 2000a, b).

2.3.2 As-if-discrete norms, common contractual norms and relational norms

Macneil (2000b) proposed that ten common contractual norms constitute an effective vehicle for satisfying the core propositions of the Relational Contracts theory (see Figure 2.1). These common contract norms offer a checklist for isolating all elements of the enveloping relations that might affect transactions significantly (Macneil, 2000b). The as-if-discrete and relational norms are particularly attributed to certain common contractual norms (see Figure 2.1), which are elaborated below.

As-if-discrete norms are the product of an intensification of two common contract norms, namely implementation of planning and effectuation of consent, whose intensification enhances discreteness and presentiation (Macneil, 1980; Macneil, 1986b). Macneil (2000b) suggested using "as-if-discrete" to describe such an extreme polar, since all discrete transactions are still embedded in relations and true discreteness seldom exist.

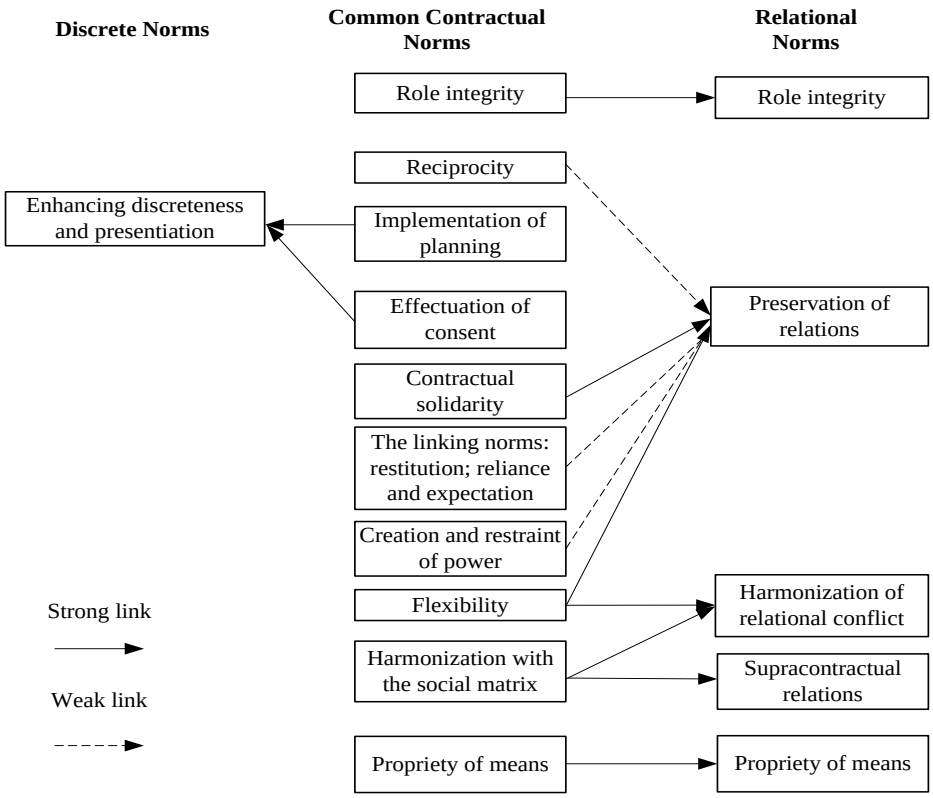


Figure 2.1: Spectrum of Macneil's contractual norms
(Source: Macneil, 1983; Blois, 2002)

Planning refers to the content of the contract and to the processes followed in the relation (Diathesopoulos, 2010). In a discrete approach, planning is pre-defined as completely as possible at the beginning of the transaction; and this process is isolated from external changes (Macneil, 1986b). Effectuation of consent in a discrete approach indicates that future actions are determined in advance (Diathesopoulos, 2010). On the contrary, planning in a more relational approach involves both transactional and relational characteristics and effectuation of consent depends on a number of factors referring to the ongoing relations (Diathesopoulos, 2010).

Reciprocity and restitution, reliance and expectation in a discrete way are served by rigorous adherence to the contract; and future obligations of content are necessarily clarified in advance (Macneil, 1986b). Thus, reciprocity only involves quantified and measurable provisions. On the contrary, reciprocity in a relational approach calls for some kind of evenness rather than equality (Macneil, 1983). Besides the quantified

and measurable provisions, reciprocity also refers to the overall behaviors anticipated from one party concerning the other (Macneil, 1983).

At the other end of the spectrum, Macneil (2000b) proposed five relational norms: (i) role integrity; (ii) preservation of the relation; (iii) harmonization of the relational conflict; (iv) supra-contract norms; and (v) propriety of means. These five relational norms are transformed and intensified from five common contractual norms (Macneil, 1983; Blois, 2002). These are role integrity (RI), contractual solidarity (SO), flexibility (FL), proprietary of means (PR) and harmonization within the matrix (HM). These five common contractual norms are elaborated and operationalized in the construction context below.

2.3.3 Norms and practices of relational contracts

Table 2.1 presents five norms and the respective measurement items. The operationalization is shown below.

Table 2.1: Five norms of relational contracts and respective measurement items

Constructs	**Code**	**Measurement items**
Role integrity (RI)	RI1	Commitment of resources to the project
	RI2	Long-term commitment
	RI3	Spirit of teamwork
	RI4	Continuous improvement
Contractual solidarity (SO)	SO1	Acceptance of agreed performance appraisal mechanism
	SO2	Alignment of objectives of different contracting parties
	SO3	Collective/combined responsibilities by a pre-selected group comprising one person from each major party
	SO4	Joint coordination and monitoring plans
Flexibility (FL)	FL1	Flexibility when situations change
	FL2	Readiness to compromise on unclear issues
Propriety of means (PR)	FM1	Clarity of division of responsibilities
	FM2	Clarity of the terms and conditions in contract
	FA1	Clearly defined equitable risk-sharing arrangement
	FA2	Real gain-share/pain-share among contracting parties
Harmonization within the social matrix (HM)	HM1	Previous relationships among each other
	HM2	Ongoing social relationships among each other

2.3.3.1 Role integrity (RI)

Role integrity indicates that each party expects their partners to behave properly and fulfill their respective obligations in an adequate way (Macneil, 1983). It becomes more important in ongoing relations because roles grow in duration, extent of human contact and range of obligations (Macneil, 1986b).

Contracting parties in a relational approach should be what they hold themselves out as being and must continue to act out this role throughout the course of the relation (Macneil, 1986a). They would "seek to overcome formal rationality to achieve goals" (Macaulay, 1985: 468) in a more functional and efficient way (Diathesopoulos, 2010). When unexpected events occur, they would seek to avoid reference to the contract (Macaulay, 1963; Blois and Ivens, 2007). This would be more likely to take place when contracting parties believe that counterparties are expected to behave "properly or adequately in all circumstances" (Misztal, 1996: 121). Expectations about the other party's behaviors thus are seen to be fundamental for relationship development (Macneil, 1983; Misztal, 1996; Graf and Perrien, 2005).

Commitment is an important aspect of performing role integrity (*e.g.*, Black *et al.*, 2000; Kumaraswamy *et al.*, 2005a). First, commitment of resources (RI1) to the project is conducive to relationship development (Rahman and Kumaraswamy, 2008). Parties should share resources since they are working as a team. However, due to scarcity of resources or worry about disclosing resources to unauthorized organizations, some parties might be unwilling to share their resources (Cheng *et al.*, 2000; Chen and Chen, 2007). This tends to impede role integrity.

Second, contracting parties need to commit on a long term basis (RI2) rather than merely focusing on present interests (*e.g.*, Cheng *et al.*, 2000). A long term

commitment may indicate parties' expectations for entering potential collaborative opportunities in the future, which might facilitate the formation of a governance mechanism in the current project.

Third, effective team building (RI3) could contribute to the achievement of role integrity (*e.g.*, Black *et al*., 2000; Chen and Chen, 2007). Project teams should be built towards an integrative approach (Love *et al.*, 2010). To achieve this, it essentially requires team working attitudes from each participant, which would enable contracting parties to take more active actions and being willing to solve contingencies in a smooth way. As a consequence, the organizational interface among parties would be weakened.

Fourth, parties should commit consistently (RI4) during the whole duration of the contract (Chan *et al.*, 2004). Within a project, the willingness to solve problems continuously is important to achieve role integrity (Cheng *et al.*, 2000). Based on the review, role integrity is operationalized as commitment of resources to the project (RI1), long term commitment (RI2), team working attitude (RI3) and continuous improvement (RI4).

2.3.3.2 Contractual solidarity (SO)

Contractual solidarity contributes to the relational norm of preservation of the relation, which could help to achieve goals at both individual and collective levels (Macneil, 1983; Moody and White, 2003). Contractual solidarity is a norm of holding exchanges together and requires contracting parties to select behaviors that facilitate the stability of the relation and allow the relation to continue (Macneil, 1986b; Diathesopoulos, 2010). To keep relationship stability, contracting parties have to operate in accordance to a set of rules, which are accepted by the large majority (Macneil 1981; Diathesopoulos, 2010).

Solidarity is "a belief not only in future peace among those involved but also in future harmonious affirmative cooperation" (Macneil, 1986a:572). One critical strategy to attain solidarity is cooperation (Macneil, 1981). Macneil (1981) indicated that cooperation is the most effective way that can produce similarity of selfish interests, whereby what increases (decreases) the utility of one participant also increases (decreases) the utility of the other. It also helps to subordinate the short term interests to long term interests (Macneil, 1986a; Diathesopoulos, 2010) and subsequently contributes to relationship stability. The purpose to improve solidarity calls for more importance on cooperative behaviors (Macneil, 1981; Diathesopoulos, 2010).

An agreed performance appraisal mechanism (SO1) is useful to facilitate cooperation (*e.g*., Rahman and Kumaraswamy, 2004a, b; 2005a). An agreed performance appraisal mechanism can ensure that the performance of each party is assessed against the same appraisal mechanism. Before reaching an agreement on a performance evaluation arrangement, diverse opinions and disagreements should be discussed and settled (Rahman and Kumaraswamy, 2004a, b; 2005a). During the implementation process, constant monitoring and checking remain important (Cheung *et al*., 2003b).

Besides, contracting parties could develop a common goal (SO2) (*e.g.*, Chan *et al.*, 2004). Liu and Fellows (2001) proposed that goal setting at project and strategic levels could enhance goal attainment in partnering relationships. Under a common goal, potential conflicts arising from each party pursuing its own objectives regardless of the benefits of the project could be then largely avoided. In the face of contingencies, common goals could also present a set of principles for seeking for mutual accepted solutions.

In the light with a common goal, role and responsibilities among contracting parties

could be collectively defined and aligned (SO3) (Thompson *et al.*, 1998; Chan *et al.*, 2004). Halman and Braks (1999) proposed that a typical structure of project alliance consists of an alliance board with a pre-selected person from each party would be helpful to alignment of different parties' objectives. This collective board could make decision unanimously and manage project objectives jointly.

Planning and monitoring should be made on a basis of combined efforts (SO4) (Rahman and Kumaraswamy, 2004a). Contracting parties could jointly share information at the planning stage and coordinate and monitor collectively. Rahman and Kumaraswamy (2002a, b) proposed using joint risk management to collectively identify and allocate potential risks. This strategy provides contracting parties with an efficient monitoring mechanism through which problems should be uncovered as early as possible. Bayliss *et al*. (2004) proposed that a questionnaire with detailed measurement parameters could be designed to assess the contract status and the project could be jointly analyzed.

Contractual solidarity is operationalized as acceptance of performance appraisal mechanism for the project (SO1), alignment of objectives of different contracting parties (SO2), collective/combined responsibilities by a pre-selected group comprising one person from each major party (SO3) and joint coordination and monitoring plans among contracting parties (SO4).

2.3.3.3 Flexibility (FL)

Intensification of flexibility contributes to the relational norm of harmonization of relational conflicts and preservation of relations (see Figure 2.1), as it can harmonize clashes within the relation between its discrete and presentiated aspects (Macneil, 1986b). Macneil (1983) noted that conflicts take place quite often between the need for adherence to planning and for flexibility to meet constantly changing

circumstances. In a discreet transaction, every future adjustment aiming at achieving flexibility is planned outside the actual exchange, as flexibility is achieved by entering or refraining from entering a contract (Macneil, 1978). Flexibility in a relational approach focuses on the parties' ability to reconstruct the content of their relations, which runs counter to the implementation of planning (Diathesopoulos, 2010). As the long-term exchanges have a far more relational scope and require necessary adjustments to achieve it, flexibility becomes increasingly important (Diathesopoulos, 2010).

The readiness to compromise on unclear issues (FL1) is critical to the adaption to the changed environment (Rahman and Kumaraswamy, 2004a, b; 2005a). Due to the difficulty in preparing a fully complete contract, contracting parties should be prepared to comprise on unclear issues when unforeseen situations occur. This would accelerate the problem solving process and cause fewer conflicts.

Flexible management styles (FL2) are also beneficial to address unclear issues and contingences (*e.g.*, Akintoye and Main, 2007; Chen and Chen, 2007). As projects face dynamics and unforeseen risks, more flexible strategies are needed (Rahman and Kumaraswamy, 2008). With sufficient flexibilities in place, parties can quickly propose measures to cope with unclearness and contingencies. The problems could then be solved in a timely way with a possible lowest cost. Based on the review, flexibility is operationlized as flexibility when situations change (FL1) and readiness to compromise on unclear issue (FL2).

2.3.3.4 Propriety of means (PR)

Propriety of means refers to "the way relations are carried on as distinct from more substantive matters, including not merely formal and informal procedures, but such things as customary behavior, often of the most subtle kind" (Macneil, 2000a: 432).

These matters can be generally classified into two groups, *i.e.*, the externally social context and the internally specific nature of every relation (Macneil, 1983). The internal propriety of means norms refers to those that the parties themselves generate in the course of the relationship, whereas the external propriety of means norms are those that have their source in the external social matrix (Macneil, 1986b). Two elements of the norm of propriety of means, namely fairness (FA) and formality (FM), are identifiable.

(i) Fairness (FA)

Although the notion of propriety of means has to be adapted to the specific parameters of each relation, fairness might provide a common standard for considering the internal propriety of means (Macneil, 1986b). In a particular relation, while the parties certainly pursue some individual goals, they are not free to accomplish them by any means without keeping substantial fairness (Diathesopoulos, 2010).

Relational approaches could be better facilitated when construction contracts are prepared with clearly defined and equitable risk allocation/sharing arrangements (FA1) (*e.g.*, Black *et al.*, 2000; Rahman and Kumaraswamy, 2008). Through this clearly defined and equitable risk sharing arrangement, contracting parties' obligations are seen to be collective rather than individual.

Fairness plays a vital role in building a win-win scenario via gain-share/pain-share arrangement (FA2) (*e.g.*, Ling *et al.*, 2006). In a real gain-share/pain-share arrangement, no party can really make extra profits (in the long term) by shifting costs to another party (Love *et al.*, 2010). This would motivate parties to work in a cooperative manner, which is the core of relational contracts. Based on the review, fairness is operationalized as clearly defined equitable risk sharing arrangement among contracting parties (FA1) and real gain-share/pain-share (FA2).

(ii) Formalities (FM)

A critical element of the external propriety of means is the adherence to the proper procedures and formalities when forming and implementing the contract (Macneil, 1986b). This is because contracting parties may fear that, if these are not carried out, they would be unsure of their respective rights and duties and therefore it would be likely to fall into a dispute (Macneil, 1986b). Having formality and formal procedures in place would ensure a certainty of their partners' behaviors. Conditions of contracts are the typical procedures and formalities in transactions. The alliance agreement in project allliancing, for instance, legally binds parties to agreed targets, risk sharing and reward mechanism (Anvuur and Kumaraswamy, 2007; Halman and Braks, 1999).

The division of responsibility (FM1) should be as clear as possible, which ensures an effective adherence to the formality. Formal contracts can serve as a framework to guide coordination through defining objectives of the relationship among contracting parties (Mooi and Ghosh, 2010). The clarity of divisions of responsibility could avoid misunderstanding of who is responsible for what. The use of standard form, Public Sector Standard Conditions of Contract (PSSCOC) for instance in Singapore's public construction projects, can increase familiarity among users and help to reduce misunderstandings.

Conditions of the contract should be as clear as possible (FM2). Woolthuis *et al.* (2005) noted that contracts can help parties in defining and aligning their expectations. Clarity in the contractual terms would therefore help partners to kick-start the trust cycle (Wong and Cheung, 2005), whereas ambiguity in the contract would result in potential conflicts and adversarial relationships as contracting parties try their best to protect their individual interests. Based on the review, formality is operationalized as clarity of division of responsibilities among contracting parties (FM1) and clarity of contract conditions (FM2).

2.3.3.5 Harmonization within the social matrix (HM)

Expansion of harmonization within the social matrix contributes to the harmonization of relational conflicts (Macneil, 1983; Blois, 2002). Harmonization within the social matrix means that relations have to comply with the overall set of factors that define exchanges in a given society (Macneil, 1983). Every exchange is developed in the social matrix which permits it to happen; and the exchange is supported by the entire institution (Macneil, 1986b). Effective analysis of transactions therefore requires a recognition and consideration of all essential elements of its enveloping relations that might affect the transaction significantly (Macneil, 2000b).

Harmonization within the social matrix also contributes to the norm of supra-contract (Macneil, 1983; Blois, 2002). Supra-contract norms are not uniquely contractual, but impinge on or enter into the relation (Macneil, 1986b). This is because relational norms tend to harmonize more with human relations rather than refined into the exchange itself and the scope of supra-contract norms is also open-ended (Macneil, 1983).

An important aspect of harmonization of relational conflicts is the necessity to deal with the whole person (Macneil, 1983). It thus calls for attentions to previous (HM1) and ongoing social relationships (HM2) of contracting parties. Previous relationships (HM1) can facilitate networks embedded in the current transaction (Uzzi, 1996; Laan *et al.*, 2012). The primary advantages in pre-existing relationships are expectations for trust and accumulated network resources. These furnish a basis for controlling fraud and benefit relationship development (*e.g.*, Uzzi, 1996; Gulati, 1999; Zaheer and Soda, 2009). A stock of previous relationships would help team members to save time to get to know each other. Contracting parties could thus avoid conflicts arising from the unfamiliarity at the outset of the project.

Prior relationships, however, may have side-effects. The negative impact is that, beyond certain point, additional networks between two firms start to diminish the likelihood of their future relationships (Gulati, 1995). It means pre-existing networks may constrain the formation of new networks. This is because stable networks would lock firms into unproductive relationships or precluding partnering with other viable firms (Gulati *et al.*, 2000; Dekker and Abbeele, 2011). The situation would be different in public construction projects since competitive tendering is widely used to select consultants and contractors without consideration of prior relationships.

Ongoing social ties (HM2) also influence parties' behaviors such that they are no longer independent actors but are embedded in a network (Granovetter, 1985). Contracting parties may utilize their strong ongoing social relationships, like "*guanxi*" and friendships, to smooth the problem-solving process or share information. Based on the literature review, harmonization within social matrix is operationalized as previous relationships between each other (HM1) and ongoing social relationships between each other (HM2).

2.4 Theory of Network Embeddedness

Network embeddedness refers to a unique logic of exchanges, which aims to interpret transactions through an angle combining network and micro rational choice (Granovetter, 1985; Uzzi, 1996; 1997). The application of network embeddedness could remedy the drawbacks of both over-socialized and under-socialized approaches.

Within the embeddedness theory, structural embeddedness refers to the extent to which a dyad's mutual contacts are connected to one another (Granovetter, 1992). It is a function of how participants interact with others, how likely future interactions

are among the participants and how likely participants are to talk about these interactions (Granovetter, 1985; 1992). This study adopts the notion of structural embeddneddness which focuses on the relationship quality at the organizational level.

2.4.1 Governance in network embeddedness

Structural embeddedness emphasizes the structure of networks and the value of the structural position of parties in the network (Gulati, 1998). The governance mechanism might be reflected by the degree of embedded networks, which depends on the type of ties it uses to connect to its network parties as well as the type of ties used by firms in the network (Uzzi, 1996; Dacin *et al.*, 1999).

The level of network embeddedness in an exchange can produce both opportunities and constraints through which contracting parties' expectations and behaviors would be shaped. These furnish the governance basis of network embeddedness. For opportunities, mutual expectations are inherent in relationships and represent one of their most fundamental properties (Granovetter, 1992). Constraints can occur when the network-based arrangements govern mutual behaviors and restrict them into a network scenario.

Two types of relationship quality are typical in networks: arm's length relationships; and embedded relationships. Arm's length relationships could be explained by the Rational Choice theory, showing selfish and profit-seeking behaviors, whereas embedded relationships present social attributes, which encourage trust, information sharing and joint problem solving (Uzzi, 1997). The detailed comparison is elaborated below.

2.4.2 Arm's length relationships

Networks composed of arm's-length ties exhibit a low level of embeddedness (Uzzi, 1996). When firms keep arm's-length ties with one another, the pattern of exchanges produces a market-like structure (Powell, 1990). These arm's-length relationships are characterized by: (i) non-specific asset investments; (ii) minimal informational exchange (*i.e.*, prices act as coordinating devices by signaling all relevant information to buyers and sellers); (iii) separable technological and functional systems within each firm that are characterized by low levels of interdependence; and (iv) low transaction cost and minimal investment in governance mechanisms (Williamson, 1985).

Arm's-length relationships are impersonal and atomistic; and actors are motivated by instrumental profit seeking (Uzzi, 1996; Uzzi and Lancaster, 2003). The transaction itself is limited to the exchange of data on price and quality (Uzzi, 1996). This type of relationship is incapable of generating relational rents because there is nothing idiosyncratic about the exchange relationship (Dyer and Singh, 1998). It would likely instead induce opportunistic actions and expectations for the distributive exchange (Uzzi and Gillespie, 2002).

2.4.3 Embedded relationships

Embedded relationships indicate that transactions are embedded in the social attachments (Uzzi and Lancaster, 2003). Parties within the embedded networks do not selfishly pursue immediate gains, but concentrate on cultivating long-term cooperative relationships that have both individual- and collective- level benefits (Uzzi, 1996). Besides, parties in an embedded network would follow heuristic and qualitative decision rules, rather than intensely calculative ones (Uzzi, 1997). It would also breed local cohesion (Granovetter 1973) and discourage malfeasance

(Granovetter, 1985). These actions and motives are not assumed to be due to purely economic behaviors and conformity to some social norms, but converge on the combination of both, furnishing an alternative mechanism for coordinating adaptation (Uzzi, 1997).

The temporary nature of construction projects causes distinctive challenges for building embedded relationships among contracting parties. Azoulay *et al*. (2010) pointed out that when a client cannot commit to give repeat business to a contractor, inter-organizational transactions between them would not be highly embedded. Under this situation, it is possible to establish a moderate degree of embeddedness (Azoulay *et al*., 2010). But the moderately embedded relationships are fragile and subject to rapid degeneration into nasty relationships since the activities that support embedded and arm's length relationships are actually substitutes (Azoulay *et al.*, 2010).

The format of embedded networks among project teams can be described as quasi-firm (Eccles, 1982), project networks (Sydow and Staber, 2002), latent organizations (Starkey *et al*., 2000), project coalitions (Pryke, 2004) and project social capital (Di Vicenzo and Mascia, 2012). Sydow and Staber (2002) refereed project networks to project organizations that are embedded in long-term relationships. Starkey *et al*. (2000) proposed the notion of latent organizations to represent project networks which are episodic and spread unpredictably over time.

The descriptions of networks among team members indicate that besides a temporary attribute, networks in the project-based sector can be embedded in more permanent contexts (Sydow and Staber, 2002; Sydow *et al.*, 2004), particularly in long-term recurrent exchanges (Dubois and Gadde, 2000). Eloranta (2007) proposed a notion of business networks, which have permanent traits, in comparison to project networks which are temporary in nature.

2.4.4 Strategies and practices of embedded relationships

Three elements are essential (*i.e.*, trust, information sharing and joint problem solving) in embedded networks (Uzzi, 1997) (see Table 2.2), which are elaborated and operationalized in the construction context below.

Table 2.2: Network strategies and respective measurement items

Constructs	**Code**	**Measurement items**
Trust (TR)	TR1	Mutual trust among each other
	TR2	Level of interpersonal relations/cultural harmony
Information sharing (IS)	IS1	Mutual understanding among each other
	IS2	Open and effective communication among each other
	IS3	Sharing of project information among each other
Problem solving (PS)	PS1	Adjustable contracts to address uncertainties
	PS2	Commitment level of contracting parties to joint problem solving
	PS3	Presence of conducive learning climate/environment
	PS4	Acceptance of dispute resolution mechanism for the project

2.4.4.1 Trust (TR)

Trust is a critical component of embedded ties (*e.g.*, Powell, 1990; Uzzi, 1996; 1997). It acts as the primary governance structure, outperforming other mechanisms, like calculative risk and monitoring systems (Uzzi, 1997). A high level of trust facilitates the exchange of resources and information that are crucial for high performance (Uzzi, 1996). Trust can create a sense of security during the knowledge sharing process, so that the knowledge would not be exploited beyond what is intended (Dhanaraj *et al.*, 2004). In addition, trust facilitates the extension of benefits to partners and invites the receiving partner to reciprocate when a new situation arises (Uzzi, 1996).

However, trust is paradoxical in transactions as it provides the opportunity for abuse through opportunism (Granovetter, 1985). Granovetter (1985) indicated that the more complete the trust, the greater is the potential gain from malfeasance. Taking the relationship between main contractors and subcontractors for example, the effect of

relationships on the cooperation can easily turn into a managerial bottleneck in spite of previous long-term familiarity (Tserng and Lin, 2002). The more the main contractor depends on the technical skills of the subcontractor, the more difficult it becomes to control costs (Tserng and Lin, 2002), thereby creating a relational risk and making new technological skills or ideas less likely to be adopted (Tserng and Lin, 2002; Unsal and Taylor, 2011).

The presence of mutual trust indicates no weak links among contracting parties in the network (Chan *et al.*, 2004). A high level of trust could create an opportunity and willingness for further business collaboration, reduce the need for continuous cross monitoring, reduce the need for formal controls, reduce the tensions created by short-term inequities and cut down cost and time outlays (Rowlinson and Cheung, 2005).

Interpersonal relationship harmony is also vital aspect of trust as the development and maintenance of relationships are largely at the inter-personal level (*e.g.*, Kumaraswamy *et al.*, 2005a; Rahman and Kumaraswamy, 2008). Personal relationships in Chinese culture form the basis of social order and correct behaviors (Pennet and Zhao, 1992). Based on the review, trust is operationalized as mutual trust between each other (TR1) and level of inter-personal relations/cultural harmony (TR2).

2.4.4.2 Information sharing (IS)

Another important component of embedded relationships is to disseminate tacit, more fine-grained and holistic information (*e.g.*, Uzzi, 1996; Uzzi, 1997; Rowley *et al.*, 2000; Mariotti and Delbridge, 2012). The dissemination of tacit information enables contracting parties to know about partners' actions and thus helps in shaping their behaviors (Granovetter, 1992). It would also facilitate beneficial types of inter-firm

coordination and learning (Uzzi, 1996). By contrast to embedded relationships which facilitate the dissemination of tacit information, arm's-length relationships promote the flow of public information (Uzzi, 1999).

Embedded relationships, however, may constrain information acquisition (Uzzi and Lancaster, 2003; Maurer and Ebers 2006). Once the relationship is embedded, parties can only draw from a limited pool of knowledge (Uzzi and Lancaster, 2003). The knowledge flow would become increasingly redundant if exchanges with existing partners repeat continuously (Maurer and Ebers 2006). In the end, acquiring novel information becomes increasingly difficult and existing information becomes less valuable. By contrast, weak ties could allow parties to access novel information (Mariotti and Delbridge, 2012). The implementation of information sharing can be facilitated by mutual understanding (IS1) (Love *et al.*, 2010), open and effective communication (IS2) (Doloi, 2009) and mutual sharing of information in construction projects (IS3) (Cheng and Li, 2001).

Mutual understanding (IS1) enables relationships to be successfully nurtured (*e.g.*, Black *et al.*, 2000; Love *et al.*, 2010). Mutual understanding means that parties need to know other parties' objectives and requirements and how these related to their own roles. A better mutual understanding helps parties to work well together to pursue a common goal instead of only focusing on individual goals. Xu *et al.* (2004) proposed that mutual understanding is required at all levels of staff rather than being restricted to senior and middle managers.

Open and effective communication (IS2) also contributes to collaborative relationships (*e.g.*, Chen and Chen, 2007; Doloi, 2009). An effective communication system plays an instrumental role in problem identification and conflict resolution (Chan *et al.*, 2004), prevents problems from becoming disputes (Wong *et al.*, 2005),

and assists in avoiding misunderstanding, rework and delays (Love *et al.*, 2010). It facilitates the exchange of ideas, visions and solutions, which can nurture mutual trust (Cheng *et al.*, 2000), and enable a mutually acceptable solution to be developed (Chen and Chen, 2007).

Sharing project information with other parties (IS3) facilitates healthy relationship development (Cheng and Li, 2001). The exchange of high quality and private information is likely to takes place in the embedded networks (*e.g.*, Uzzi, 1996; Rowley *et al.*, 2000; Mariotti and Delbridge, 2012). Effective sharing of project information enables parties to acquire accurate progress of the project and discover potential problems at the early stage. It would thus facilitate inter-firm coordination and learning (Uzzi, 1996). By contrast, arm's-length relationships promote the flow of public information (Uzzi, 1999), indicating that contracting parties are restricted to the formal information only. Based on the review, information sharing is operationalized as mutual understanding (IS1), open and effective communication (IS2) and sharing of project information with each other (IS3).

2.4.4.3 Joint problem-solving (PS)

Embedded networks tend to furnish joint problem-solving arrangements (Uzzi, 1997). Joint problem-solving arrangements could enable contracting parties to coordinate functions and work out problems "on the fly" (Uzzi, 1996; 1997). These arrangements typically consist of routines of negotiations and mutual adjustment that could flexibly resolve problems and effectively promote the learning process (Uzzi, 1997). Appropriate problem-solving mechanisms, like joint problem solving (Cheng and Li, 2002) and other mutually agreed resolution (Rahman and Kumaraswamy, 2005a), are crucial to build collaborative relationships (*e.g.*, Chan *et al.*, 2004; Chen and Chen, 2007).

Some studies highlighted the vital role of flexibility in contracts (PS1) in collaboration at post-contract stage (Rahman and Kumaraswamy, 2002a, b). Given the limitation in cognition (Eisenberg, 1994) and complexity of construction projects, contracting parties are unable to define all the contingencies that may occur later on. Uncertainties are hence inevitable in construction projects. Flexibility in contracts is helpful to address these drawbacks (Badenfelt, 2011).

Joint problem solving (PS2) plays an important role in nurturing collaborative relationships (*e.g.*, Cheng and Li, 2002; Chen and Chen, 2007). Joint risk management, for instance, may be an alternative way to solve problems collectively (Rahman and Kumaraswamy, 2002a, b). Conflicts might frequently occur among parties because of potential discrepancies in goals and expectations of each party. Joint problem solving could be an effective way to settle such conflicts since relevant parties have the chance to speak out.

The presence of a learning climate (PS3) is critical to relationship development (Cheng and Li, 2001). Cheng and Li (2001) noted that learning climate could encourage each party to disclose their risks and jointly propose measures to address them. Having learning climate in place would form up a comfortable environment for the execution of joint problem solutions.

Contracting parties' acceptance of the dispute resolving mechanism (PS4) is also conducive to relationship development (Rahman and Kumaraswamy, 2004a, b; 2005a). The acceptance of the dispute resolving mechanism would be helpful to avoid the escalation of conflicts and reduce conflicts. Some dispute resolution methods are particularly devised for smooth relationship development, like one such method called "swing man process" (Hayford and Utz, 2002). In this process, disputes which cannot be resolved unanimously by the alliancing board are referred to an

independent third party, and each alliance participant makes a submission on how the dispute should be resolved (Hayford and Utz, 2002). The independent third party then chooses from these submissions, having regard to the terms of the alliance agreement (Hayford and Utz, 2002). Hayford and Utz (2002:85) explained that "each party will be discouraged from making an extreme submission, for fear that the third party will prefer the other's position, and this will assist in achieving a resolution which all the participants can live with, minimizing any ongoing damage to the alliance relationship".

Based on the review, joint problem solving is operationalized as adjustable contracts to address uncertainties (PS1), commitment of contracting parties to joint problem solving (PS2), presence of conducive learning climate/environment (PS3) and acceptance of dispute resolution mechanism for the project (PS4).

2.5 Summary

From the literature review in the preceding sections, it can be seen that transactions in a construction project organization range from discrete or arm's length formal transaction to relational transactions. In formal transactions, parties rely on formal contracts to govern their rights, liabilities and responsibilities as explained by the Theory of Rational Choice (see section 2.2). However, due to the interdependence nature of the work, parties in a construction project organization are not expected to behave in an atomized manner nor would they regard the project as a spot contract. It is suggested that relational transactions would be practiced.

Relational transactions in a construction organization may be explained by two theories, namely the theory of Relational Contracts (see Section 2.3) and the theory of Network Embeddedness (Section 2.4). According to the theory of Relational

Contracts, five norms guide and control RC practices (see Section 2.3.3), which are role integrity (RI), contractual solidarity (SO), flexibility (FL), proprietary of means (PR) and harmonization within the matrix (HM).

Besides, parties' expectations, opportunities and actions may be influenced by existing ties among each other, and expectation for future interactions. These may be explained by the theory of Network Embeddedness (see Section 2.4). According to this theory, actors may have different degree of embeddedness in a network (*i.e.*, embedded relationships and arm's length relationships), which could shape the expectations and opportunities in the current exchange, acting as a governance mechanism. In an embedded network, three elements, namely trust (TR), joint problem resolving (PS) and information sharing (IS), are essential (Uzzi, 1997) (see Section 2.4.4).

Chapter 3 Literature Review and Conceptual Framework

3.1 Introduction

This chapter presents the conceptual framework (Section 3.2) which comprises five main themes: relational transaction practices (X); project outcomes (Y); relationship quality (Z); and drivers (C) of and barriers (D) to relational transactions. The operationalization of the constructs of relational transactions (X), project outcomes (Y) and relationship quality (Z) is shown in Sections 3.3, 3.4 and 3.5 respectively. The operationalization of drivers (C) of and barriers (D) to relational transactions is covered in Section 3.6 and 3.7 respectively. This is followed by Section 3.8 that summarizes the characteristics of public project management and procurement. Based on the literature review, four knowledge gaps are identified in Section 3.9. The hypothetical relationships in the conceptual framework are introduced in Section 3.10.

3.2 Conceptual Framework

Figure 3.1 shows the conceptual framework of this study. Formal transactions may be explained by the theory of Rational Choice (Becker, 1976) (see Section 2.2). As complete reliance on formal contract may lead to adversarial relationships, parties in a construction project are expected to adopted relational transactions. Under relational transactions, parties might adopt RC norms underpinned by Macneil's (1978) theory of Relational Contracts (see Section 2.3). Besides, actors in the construction industry are likely to have worked with each other in the past and also possibly have opportunities to work together again in future projects. Granovetter's (1985) theory of Network Embeddedness could be used to explain their behaviors based on past and possible future relationships (see Section 2.4) and parties adopt network strategies.

As shown in Section 1.3, this study aims to examine the relationships among relational transactions (X), relationship quality among contracting parties (Z) and project outcomes (Y). The operationalization of the constructs is presented in Sections 3.3 to 3.5. Figure 3.1 also shows the hypothetical relationships among them which are elaborated in Section 3.10.

Besides, Figure 3.1 also shows the factors impeding (D) and motivating (C) the adoption of relational transactions. Nine drivers and nine barriers are identified. These constructs are operationalized in Sections 3.6 and 3.7.

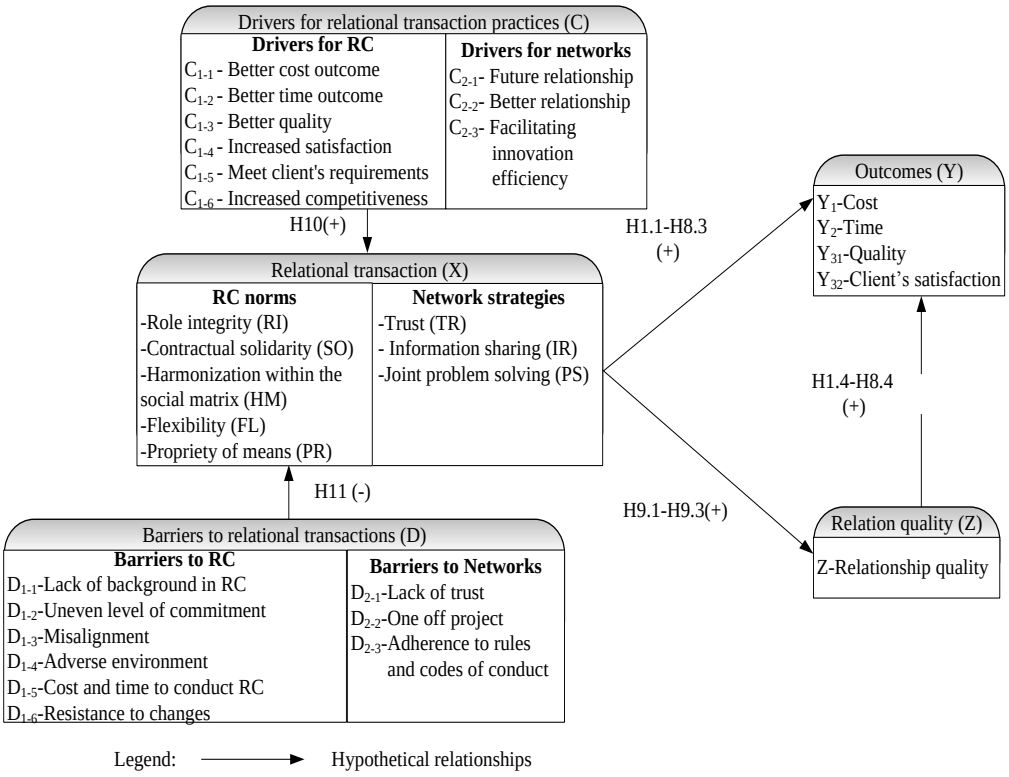


Figure 3.1: Conceptual framework for boosting public project outcomes through relational transactions

3.3 Relational Transaction Practices (X)

Figure 3.1 shows that relational transaction practices comprise five RC norms and three network strategies. The relevant practices were operationalized in Sections 2.3.3 and 2.4.4 and summarized in Tables 2.1 and 2.2. As a construction project comprises

many contracting parties, it is expected that the degree of the adoption of relational transaction practices by different parties could be uneven. The relational transaction practices identified from the literature review may be further classified as follows: (i) practices exhibited by individuals (*e.g.*, role integrity (RI) and flexibility (FL)); (ii) practices exercised between two parties (*e.g.*, trust (TR), information sharing (IS) and harmonization within the social matrix (HM)); and (iii) practices undertaken by triple parties (*e.g.*, contractual solidarity (SO), propriety of means (PR) and joint problem solving (PS)).

3.4 Project Outcomes (Y)

Figure 3.1 shows that project outcomes are operationalized into cost performance (Y_1), time performance (Y_2), quality performance (Y_{31}) and client's satisfaction (Y_{32}). These indicators are reviewed below.

3.4.1 Cost performance (Y_1)

Table 3.1 presents the measurements of project cost performance and its description. Among these, the measurement of comparing contract cost to the final cost was preferred since it could represent the project cost performance across different categories of projects.

Besides the measurements of cost performance, Table 3.2 shows that both Likert scale and specific metrics have employed in past studies. However, for the scale with unequal intervals (*e.g.*, Molenaar *et al.*, 1999; and Chan *et al.*, 2001), the mean of all responses seems less meaningful since it would trim the raw data inappropriately.

An objective way to measure cost performance is to compare actual cost to the budget. To ascertain cost performance, respondents were asked to provide information on

construction contract sum and final construction cost. Using these, the cost performance could be assessed. It was recognized that some respondents were unwilling to reveal contract sum. Respondents were therefore allowed to indicate the percentage difference between contract sum and final contract cost.

Table 3.1: Measurements of cost performance

Constructs	**Description**	**References**
Overall project cost	Final out-turn cost for overall project including infrastructure	Ahadzie *et al.*, 2008
Cost performance of service	Actual versus budget	Ling *et al*., 2006; 2008; 2009; Chan *et al.*, 2001; Chua *et al*., 1997; Luu *et al*., 2008
Unit cost (dollars/m^2)	Final project cost/area/index	Konchar and Sanvido, 1998; Ling *et al*., 2002; Ling, 2004
Cost growth (%)	[(final project cost-contract cost)/contract project cost]* 100	Konchar and Sanvido, 1998; Ling *et al*., 2002; Ling, 2004
Intensity [(dollar/m^2)/month]	Unit cost of design and construction work put in place in a facility per unit time (unit cost/total time)	Konchar and Sanvido, 1998; Ling *et al*., 2002
Budget performance	The project is completed at or under the contracted cost	Molenaar *et al.*, 1999; Songer and Molenaar, 1997 [#]
Cost index	Final cost*100/Initial cost where initial cost is the tender price	Dissanayaka and Kumaraswamy, 1999

Note: [#]denotes it is used for public projects

Table 3.2: Measurement scales of cost performance

Measurement scale	**References**
>10%, 10%-6%, 6%-3%, 3% - -3%, -3% - -10%, -10%>	Chua *et al*., 1997
>5%, 5%-3%, 2%-1%, on budget, -1%>- -2%, -3% - -5%, <-5%	Molenaar *et al*., 1999
>5%; cost same as budget; <-5%	Ling *et al.*, 2006; 2008; 2009
≥10%, 10%-6%, 6%-1%, 1%>, 0	Chan *et al*., 2001
Likert scale, like 5-point or 7-point	Songer and Molenaar, 1997[#];

Note: [#] denotes it is used for public projects

3.4.2 Time performance (Y_2)

Table 3.3 shows that time performance can be measured in many ways. Among these, percentage difference between actual and planned time was selected for this study as it is an accurate way to measure time performance.

Like the review of cost performance, scales of time performance were also pooled (see Table 3.4). By virtue of the argument in selecting scale of cost performance, the way to ask respondents to provide planned duration and actual duration appears more accurate to assess time performance. It was thus adopted in this study.

Table 3.3: Measurements of time performance

Constructs	**Descriptions**	**References**
Overall project duration	Time taken to complete entire project including provision of infrastructure	Ahadzie *et al*., 2008
Time/schedule performance of service	Actual versus planned	Ling *et al*., 2006; 2008; 2009
Construction speed (m^2/month)	Area/(as-built construction end date-as built construction start date)	Konchar and Sanvido, 1998; Ling *et al*., 2002; Ling, 2004
Delivery speed (m^2/month)	Area/total time	Ling *et al*., 2002; Ling, 2004
Schedule growth (%)	[(Total Time -Total As-Planned Time)/total As-Planned Time]*100	Konchar and Sanvido, 1998; Ling *et al*., 2002; Ling, 2004
Schedule performance	The project is completed on or before the contracted finish date	Songer and Molenaar, 1997[#]; Molenaar *et al.*, 1999
Time index	Actual duration*100/programmed duration where the programmed duration span from the agreed construction commencement date to the planned completion date	Dissanayaka and Kumaraswamy, 1999
Construction time performance	Discounted construction time/(revised construction time)*100	Luu *et al.*, 2008

Note: [#] denotes it is used for public projects

Table 3.4: Measurement scales of time performance

Measurement scale	**References**
>5%; finish on time; -5%>	Ling *et al.*, 2006; 2008; 2009
≥10%, 10%-6%, 6%-1%, 1%>, 0%	Chan *et al.*, 2001
>6%, 5%-3%, 2%-1%, on budget, -1% - -2%, -3% - -5%, -6%>	Molenaar *et al*., 1999
Likert scale, like 5-point or 7-point	Songer and Molenaar, 1997 [#]

Note: [#] denotes it is used for public projects

3.4.3 Quality performance (Y_{31})

Table 3.5 presents the different ways used to assess quality performance. Among these, product quality was preferred since it could represent the project quality rather than individual's quality performance. Therefore, this study operationalizes quality

performance as: product/output quality of the facility (1=expectations not met, 3=expectations met, 5=exceed expectations).

Table 3.5: Measurements of quality performance

Descriptions	**References**
Output quality of your service *e.g.*, technical quality, workmanship quality, architectural quality, functional quality.	Ling *et al*., 2006; 2008^
Turnover quality (ease of starting up and extent of call backs)	Ling *et a*l., 2002^;
System quality (performance of building elements, interior space and environment);	Ling *et al*., 2002^;
Equipment quality (performance of equipments)	Ling *et al*., 2002^;
Both workmanship and product	Cox *et al*., 2003;
Defects; quality issues at available for use; quality Issues at end of defect rectification period	The KPI Working Group, 2000
Meets specifications; the completed project meets or exceeds all technical performance specifications provided by owner	Songer and Molenaar, 1997 #.
High quality of workmanship: the completed project meets or exceeds the accepted standards of workmanship in all areas	Songer and Molenaar, 1997 #.
The degree of quality management system performance	Luu *et al.*, 2008^

Note: #denotes it is used for public projects; ^denotes Likert scale

3.4.4 Client's satisfaction (Y_{32})

In addition to the triple project objectives, satisfaction was adopted to be another outcome criterion (*e.g.*, Molenaar *et al.*, 1999; Chan and Chan, 2004; Muller and Turner, 2007) (see Table 3.6). Satisfaction may be from the point of view of: ender-users (Chan and Chan, 2004; Müller and Turner, 2007); design team (Chan and Chan, 2004); supplier (Muller and Turner, 2007); construction team (Chan and Chan, 2004); customer satisfaction (Muller and Turner, 2007); other stakeholders (Muller and Turner, 2007); and public/community (Ling *et al*., 2009). Overlap may exist in these measurements. For instance, stakeholder satisfaction indicated by Baccarini (1999) may incorporate user satisfaction. Although this study did not explicitly measure safety performance, it is realized that project safety performance is an important consideration in client's satisfaction.

Given the difficulty in obtaining a comprehensive response from end-users, all the stakeholders or participants in the project, respondents were requested to rate their perception of the client's satisfaction with the project. Hence, this construct is operationalized as client satisfaction (1=expectations not met, 3=expectations met, 5=exceed expectations).

Table 3.6: Measurements of satisfaction

Constructs	**Descriptions**
Public satisfaction	Satisfaction on the project (Ling *et al*., 2009^).
Client's satisfaction	Satisfaction on services: cooperation with the owner; organization and administration at site; a sense of responsibility; the provision of solution to solve defective works (Ling *et al*., 2002^; Luu *et al.*, 2008^).
	Satisfaction on product: construction schedule performance; construction quality; aesthetic of construction products; construction materials and equipment (Luu *et al*., 2008^).
	Satisfaction product – standard; satisfaction service – standard criteria headline; satisfaction – client-specified criteria (The KPI Working Group, 2000).
	Minimizes construction aggravation: the construction process does not unduly burden the owner's project management staff (Songer and Molenaar, 1997#).
	Owner satisfaction; administration burden; conform to the user's expectations (Molenaar *et al*., 1999^).
Stakeholder's satisfaction	Satisfaction on product success and project management success (Baccarini, 1999).
Project participants' satisfaction	Satisfaction on time, cost, quality of design and quality of workmanship (Chan *et al*., 2001a^).
	Satisfaction on profit, getting new orders and learning possibilities (Westerveld, 2003).
Users' satisfaction	Users are concerned with their overall influence in the project and functionality of the end product (Westerveld, 2003).
	The completed project meets or exceeds the user's envisioned functional goals (fitness for purpose) (Songer and Molenaar, 1997#).

Note: #denotes it is used on public projects; ^denotes use of Likert scale

3.5 Relationship Quality (Z)

Figure 3.1 shows adoption of relational transaction practices (X) is expected to enhance relationship quality among contracting parties (Z). Relationship quality refers to the networks created by inter-firm partnerships of groups of firms, indicating the history of multiparty networks in which firms have been engaged (Hagedoorn, 2006).

Past studies proposed that good relationship is an objective for adopting relational transactions (Dubois and Gadde, 2000; Yeung *et al.*, 2009; Radziszewska-Zielina, 2010). While most public clients have close working relationships with regulatory agencies (Minchin *et al.*, 2010), they have relationship gaps with their private partners (*e.g.*, Gibb and Isack, 2001; Smyth and Edkins, 2007). This might be because private parties are mostly profit oriented, whereas public clients are very conservative in commercial relationships due to the involvement of public funds.

Poor relationships (*i.e.*, arm's-length relationships) are cold and atomistic, and actors are motivated by instrumental profit seeking (Uzzi and Lancaster, 2003). In contrast, good relationships (*i.e.*, embedded relationships) embed the transaction into the social attachment (Uzzi and Lancaster, 2003). As this study targets three parties (*i.e.*, public clients, main contractors and lead consultants) in public projects, the quality of relationship refers to the strength of the relationship between: (i) client and contractor (Z_1); (ii) consultant and contractor (Z_2); and (iii) client and consultant (Z_3).

3.6 Drivers for Adopting Relational Transactions (C)

3.6.1 Drivers for adopting RC practices (C_1)

Figure 3.1 shows that six drivers may motivate contracting parties to adopt RC practices. These are better cost outcome, better time outcome, better quality, increased satisfaction, meeting clients' requirements and increased competitiveness. These constructs are operationalized below.

3.6.1.1 Better cost outcome ($C_{1\text{-}1}$)

Parties adopt RC practices because of the aim to accomplish better cost (*e.g.*, Larson, 1995; Chan *et al.*, 2008). RC Practices can give rise to a reduction in total project cost because partners are able to purchase at the lowest possible cost (Beach *et al.*, 2005) and control cost more effectively (Larson, 1995; Chan *et al.*, 2008). Based on a

European case, Kumaraswamy and Matthews (2000) found that despite longer and costlier selection process, subcontractors' pricing levels were reduced by about 10% due to the efficiency arising from the partnering.

RC practices also give rise to better cost outcome through the reduction of risks (Cheatham, 2004; Akintoye and Main, 2007). Cheatham (2004) argued that under collaborative arrangements parties have mutual interests in sharing and spreading risks associated with long-term contracts.

Better cost outcome is operationalized as the reduction of total project cost (Akintoye and Main, 2007) (C1), the reduction of risks or the mitigation of their influence (Li *et al.*, 2001) (C2), and the reduction of the cost of changing partners (Black *et al*., 2000) (C3).

3.6.1.2 Better time outcome ($C_{1\text{-}2}$)

Contracting parties are motivated to adopt RC practices since they hope to achieve better time outcome (*e.g.*, Akintoye and Main, 2007; Bresnen and Marshall, 2000c). Based on a study of 280 construction projects, Larson (1995) found that partnership-based projects reaped better results in time performance compared with those projects managed in an adversarial manner. The adoption of RC practices would facilitate the development of an easier and smoother decision-making process (Chan *et al., 2008*). Timely response and fast decision making process in public projects tend to reduce clients' administration burden. Better time outcome is operationalized as the reduction in time needed to deliver the project (Black *et al*., 2000) (C4) and the reduction in a public client's administration burden (Black *et al.*, 2000) (C5).

3.6.1.3 Better quality (C_{1-3})

Contracting parties that adopt RC practices are motivated by the benefits of better quality product (Black *et al*., 2000; Chan *et al.*, 2003a). The improved performance can be attributed to superior design (Black *et al.*, 2000), fast response to technology changes (Akintoye and Main, 2007), improved buildability (Bresnen and Marshall, 2000c), improved design (Chan *et al*., 2003a) and better safety performance (Chan *et al.*, 2003a). Better quality performance is thus operationalized as the improvement in the quality of project (Black *et al.*, 2000) (C6), improvement in the design (Black *et al.*, 2000) (C7) and the achievement of better safety performance (Chan *et al.*, 2003a) (C8).

3.6.1.4 Increased satisfaction (C_{1-4})

Contracting parties that adopt RC practices are driven by the increased satisfaction (*e.g.*, Akintoye and Main, 2007; Chan *et al.*, 2003a). Besides, contracting parties adopt RC practices with the aim to achieve higher efficiency of resource utilization (Black *et al.*, 2000) and to design an integrated problem solving arrangement (Chan *et al.*, 2003a). The use of an integrated solution allows conflicts to be resolved in a smooth manner and help to cultivate a collaborative culture (Akintoye and Main, 2007). Consequently, contracting parties would be more satisfied with the results.

The satisfaction related motivation is operationalized as the maximization of resource utilization (Black *et al*., 2000) (C9), the response to a collaborative culture in a project (Akintoye and Main, 2007) (C10) and the provision of an integrated solution to improve efficiency (Chan *et al.*, 2003a) (C11).

3.6.1.5 Meeting clients' requirements (C_{1-5})

Contracting parties adopt RC practices because of the responsiveness to users' requirements (Bresnen and Marshall, 2000c) and clients' requirements (Akintoye and

Main, 2007). Akintoye and Main's (2007) study discovered that the most important reason identified by contractors for a collaborative relationship is its impacts on the response to a client's need. Likewise, Swan and Khalfan (2007:119) summed up the key driver as "because they have been told to".

The growth of partnerships within the public sector has been driven by policies from central governments, for example, in countries such as Australia, Denmark, and the UK (Ng *et al.*, 2002; Kadefors *et al.*, 2007; Eriksson *et al.*, 2008). Meeting clients' requirements is thus operationalized as the response to public needs (Akintoye and Main, 2007) (C12).

3.6.1.6 Increased competitiveness ($C_{1\text{-}6}$)

Contracting parties adopt relational approaches with the aim to increase competitiveness (*e.g.*, Love *et al.*, 2002; Lu and Yan, 2007). Lu and Yan (2007:166) found that "to increase bidding advantages" and "to improve long-term competitive advantages" are the top two partnering incentives. The competitiveness related motive is operationalized as the response to competitors' actions (Akintoye and Main, 2007) (C13), the improvement in an organization's competency (Black *et al.*, 2000) (C14), and the enhancement of an organization's reputation (Ross, 2003) (C15).

3.6.2 Drivers for adopting network strategies (C_2)

Figure 3.1 shows that three drivers are expected to influence the adoption of network strategies. These are better relationships, future relationships and facilitating innovation in efficiency. These are operationalized below.

3.6.2.1 Better relationships ($C_{2\text{-}1}$)

Contracting parties adopt network strategies because of the aim to improve relationship quality (*e.g.*, Dubois and Gadde, 2000; Radziszewska-Zielina 2010). Better relationships could further produce project-based benefits (Black *et al.*, 2000). The construct of better relationships is operationalized as the reduction of disputes during a project (Dubois and Gadde, 2000) (C16) and the building of closer relationships with contracting parties (Black *et al.*, 2000) (C17).

3.6.2.2 Future relationships ($C_{2\text{-}2}$)

Contracting parties that adopt network strategies are driven by the expectation of having future cooperation. The expectation of future relationships can affect current transactional behaviors, even relationships in certain projects are confined to the contract duration (*e.g.*, Tempest and Starkey, 2004; Levin *et al*., 2010). Black *et al*. (2000) found that this impact of future relationships on current behaviors would be differently perceived by different parties. Contractors and consultants, for example, believed that they should build good relationships with clients when they are fairly dependent on a client for business. Securing a long-term relationship with this client would enhance the possibility of securing future contracts (Black *et al.*, 2000). However, clients do not believe that consultants and contractors should enter into partnerships with them to maintain a long term business relationship as they "prefer the traditional power they have over their suppliers" (Black *et al.*, 2000:431). The future relationship related motive is operationalized as the seizing of new market opportunities (Black *et al.*, 2000) (C18) and the achievement of continuity for past relationships (Dubois and Gadde, 2000) (C19).

3.6.2.3 Facilitating innovation efficiency ($C_{2\text{-}3}$)

The adoption of network strategies in projects might be attributed to the purpose to facilitate innovation efficiency. Embedded networks promote creativity by facilitating

common identity, promoting free exchange of knowledge, thereby accessing to new technology and reducing the costs of acquiring knowledge (Dyer and Nobeoka, 2000; Akintoye and Main, 2007). However, Dubois and Gadde (2000) stated that little benefits could be gained from shared learning if the relationship is confined to the duration of a single project. This is common in the construction sector, because projects are temporary in nature. As a consequence, contracting parties might reduce their enthusiasm in adopting network strategies to enhance innovation efficiency. The driver of facilitating innovation efficiency is operationalized as the response to technology changes (Akintoye and Main, 2007) (C20) and the facilitation of creative and innovative approaches (Dyer and Nobeoka, 2000) (C21).

3.7 Barriers to Adopting Relational Transactions (D)

Figure 3.1 shows that the adoption of relational transaction practices may also simultaneously face nine obstacles. These are reviewed below.

3.7.1 Barriers to RC practices (D_1)

Figure 3.1 shows that six barriers might impede the adoption of RC practices. These are: (i) lack of background in RC practices, (ii) uneven level of commitment, (iii) misalignment among contracting parties, (iv) adversarial environment among contracting parties, (v) cost and time to conduct RC practices; and (vi) resistance to changes. These are operationalized below.

3.7.1.1 Lack of background in RC practices (D_{1-1})

A lack of background in RC practices would undermine the effectiveness of RC practices. A lack of RC experience, for example, engenders a negative impact on RC success (Chan *et al.*, 2003b). Two situations may be the reflection for the lack of RC experience. First, people have never adopted RC practices before and therefore not

seen the full impact of RC practices (Akintoye *et al.*, 2000). Second, people who have the relevant experience but do not fully understand RC practices (Glagola and Sheedy, 2002). Both might cause RC practices to be incorrectly applied and hence probably contribute to the failure of the project.

Past adversarial relationships and experiences also hinder the current implementation of RC practices (Glagola and Sheedy, 2002). Failure to reap benefits from past RC experiences may lead to ego and self-interest in the present project (Glagola and Sheedy, 2002). The lack of background in RC practices is operationalized as the lack of knowledge of relational approaches (Kumaraswamy *et al.*, 2005) (D1), the lack of training and guidance in a relational arrangement (Ng *et al.*, 2002) (D2), past negative experience of a relational arrangement (Glagola and Sheedy, 2002) (D3), misgivings about future relationships (Akintoye and Main, 2000) (D4) and the lack of experience in relational arrangements (Glagola and Sheedy, 2002) (D5).

3.7.1.2 Uneven levels of commitment ($D_{1\text{-}2}$)

A lack of commitment to RC practices is detrimental to the use of RC practices (Cook and Hancher, 1990). For example, unenthusiastic participation in RC practices contribute to RC failure (*e.g.*, Drexler and Larson, 2000; Ng *et al.*, 2002), like failure to perform as expected in preset arrangements (Ng *et al*., 2002) and an unwillingness to compromise (Akintoye and Main, 2000; Drexler and Larson, 2000). Clients' unwillingness to initiate RC development might force the contract into the traditional adversarial route (*e.g.*, Hayford and Utz, 2002; Ng *et al.*, 2002).

A lack of top management support also impedes the adoption of RC practices (Akintoye *et al.*, 2000; Eriksson *et al*., 2008). It would deter individual decision maker from trying new approaches regardless of the potential advantages (Eriksson *et*

al., 2008). As the top management commitment wanes, the commitment at the project level follows suit (Akintoye *et al.*, 2000).

A lack of acceptance of relational approaches as a long term way to do business is also a barrier to adopting RC practices (Bresnen and Marshall, 2000b; Ng *et al.*, 2002). This lack of acceptance would further have a negative effect on parties' commitment levels and lead to passive participation in the implementation of RC practices.

Uneven levels of commitment is operationalized as the unenthusiastic participation of contracting parties (Eriksson *et al.*, 2008) (D6), the lack of top management support (Akintoye *et al.*, 2000) (D7), the lack of acceptance by contracting parties of relational approaches as a long-term way of doing business (Ng *et al.*, 2002) (D8), and the lack of client's initiative in RC practices (Akintoye *et al.*, 2000) (D9).

3.7.1.3 Misalignment among project team members (D_{1-3})

A lack of common goals is a barrier to the implementation of RC practices (Glagola and Sheedy, 2002), such as the goals of the client are substantially different from those of the contractor (Cook and Hancher, 1990) and self-interest of each party (Drexler and Larson, 2000; Packham *et al.*, 2003). A lack of common goals would lead contracting parties to pursue their own objectives regardless of the overall project performance which might lead to conflicts. As a result of conflicts, relationships would worsen. Misalignment among project team members is operationalized as the lack of common goals among contracting parties (Drexler and Larson, 2000) (D10).

3.7.1.4 Adversarial environment among project team members (D_{1-4})

Adversarial environment impedes the implementation of RC practices. For example, inter-personal clash would impede RC practices (Rahman and Kumaraswamy, 2008). This clash may occur because of an extreme position dominated by self-interest (Drexler and Larson, 2000) and indifference (Drexler and Larson, 2000; Glagola and Sheedy, 2002). As a consequence of the cultural clash, conflicts might easily take place, which would further inhibit the formation of unwritten agreement among contracting parties.

Opportunistic behaviors of one or more contracting parties are a barrier to RC practices (Kumaraswamy *et al.*, 2005a; Rahman and Kumaraswamy, 2008). Relying heavily on extensive and formal contracts may increase opportunism, since the standard contracts are too rigid and do not emphasize collaboration and sharing of responsibilities and risks (Lazar, 2000; Eriksson *et al.*, 2008). This would result in higher transaction cost incurred by monitoring each party closely.

Adversarial culture is also an impediment to RC practices (*e.g.*, Bresnen and Marshall, 2000c). The adversarial culture might emerge from the parties' incompatible culture and adversarial attitudes (*e.g.*, Eriksson *et al.*, 2008; 2009; Ng *et al.*, 2002). Adversarial culture would lead contracting parties to work against each other, pursuing their own objectives which might be inconsistent with the overall project targets.

This construct is operationalized as inter-personal/cultural clash (Ng *et al.*, 2002) (D11), concerns about the opportunistic behaviors of other contracting parties (Kumaraswamy *et al.*, 2005) (D12), and incompatible organizational cultures among the contracting parties (Ng *et al.*, 2002) (D13).

3.7.1.5 Cost and time to conduct RC (D_{1-5})

Additional cost is incurred in practicing RC practices, which is one of the reasons to avoid use of RC practices. Money needs to be spent to establish, develop and maintain the collaborative relationships (Ross, 2003). Glagola and Sheedy (2002) indicated that the cost of partnering is approximately 0.15% of the total project cost, according to a survey by the U.S. Army Corps of Engineers. Public projects that need to achieve transparency would have difficulties in justifying the additional expense incurred.

Additional time needed in implementing RC practices is a barrier to the adoption of RC practices (Cook and Hancher, 1990). A significant amount of time is required to find right partners, build the team, establish and implement procedures and rules (Cook and Hancher, 1990). Personnel in each party also need to spend time on nurturing close working relationships between each other. An integrative and collaborative culture is difficult to be cultivated without these efforts. This construct is operationalized as the high cost in adopting relational approaches (Glagola and Sheedy, 2002) (D14) and the time required to develop a relationship (Cook and Hancher, 1990) (D15).

3.7.1.6 Resistance to changes (D_{1-6})

Compared to the private sector, the public sector shows greater reluctance to rapid changes (Palaneeswaran and Kumaraswamy, 2000), which might deter them from embracing RC practices. Public clients usually prefer to the traditional routines even if they agree with the RC practices in principle (Palaneeswaran and Kumaraswamy, 2000; Clifton *et al.*, 2004; Lædre *et al.*, 2006). This construct is operationalized as "conservative industry culture inhibits changes and encourages preservation of the status quo" (Clifton *et al.*, 2004) (D16).

3.7.2 Barriers to network embeddedness (D_2)

Figure 3.1 shows that three barriers might inhibit network strategies. These are lack of trust, one-off nature of projects and adherence to rules and codes of conducts. These are operationalized below.

3.7.2.1 Lack of trust ($D_{2\text{-}1}$)

A lack of trust is a serious barrier for collaborative relationships (*e.g.*, Drexler and Larson, 2000; Akintoye and Main, 2007). Once trust has been broken, it would be difficult to salvage the relationship (Drexler and Larson, 2000). It would then inhibit project success (Packham *et al.*, 2003).

A lack of mutual trust might be due to a lack of empowerment (Ng *et al.*, 2002). A lack of empowerment on part of the client's representatives would also inhibit efficiency of the problem resolution process (Ng *et al.*, 2002). The inefficiency in problem solving process might further hamper the commitment of contracting parties. This construct is operationalized as the lack of empowerment in the client's representatives (Ng *et al.*, 2002) (D17) and the lack of trust among contracting parties (Akintoye and Main, 2007) (D18).

3.7.2.2 One-off nature of projects ($D_{2\text{-}2}$)

Many clients demand built products irregularly. This lack of continuity of relationships frequently undermines attempts to secure the full benefits of collaboration (Tookey *et al.*, 2001). Packham *et al.*, (2003) noted that relational transactions are unlikely to have a significant impact upon the decisions of suppliers unless they are convinced by the fact that the adoption of relational transactions can improve their chances of survival. Hence, clients would face more constraints in implementing relational approaches if they only demand for projects on an occasional

basis. The construct is therefore operationalized as "client only has occasional need for project development" (Packham *et al.*, 2003) (D19).

3.7.2.3 Adherence to rules and codes of conduct ($D_{2\text{-}3}$)

The public sector needs to adhere to numerous codes of conduct (Ng *et al.*, 2002), stringent public rules, regulations and laws (*e.g.* Ross, 2003; Minchin *et al.*, 2010). It also has accountability concerns (Ross, 2003), which should be managed carefully. Public procurement legislation mainly aims to facilitate competition and non-biased procurement decisions, which are often seen as working against collaborative relationships (Ng *et al.*, 2002; Eriksson *et al*., 2008).

Due to these pre-set regulations, public clients would face relatively more constraints on the form and substance of their internal operations and contractual relationships (*e.g.*, Crowley and Karim, 1995; Chan *et al.*, 2001b). Within the internal organization, public sector would be burdened by a tedious stepwise decision-making system (Rahman and Kumaraswamy, 2004b). Their organizational boundaries are usually rigid and impermeable since employees and their departments have well-defined jurisdictions, responsibilities and a hierarchy of authority (Crowley and Karim, 1995).

In addition to the internal restrictions, contracting parties may spawn on close relationship activities with their partners because of the avoidance of possible allegations of corruption. There is a possibility that a close relationship may lead to decisions being made in an unfair and unethical manner (Glagola and Sheedy, 2002).

Adherence to rules and codes of conduct is operationalized as public sector accountability concerns (Rahman and Kumaraswamy, 2004b) (D20), bureaucratic public client organization (Ng *et al.*, 2002) (D21), stringent public rules, regulations and laws (Rahman and Kumaraswamy, 2004b) (D22), and the need to avoid possible

allegations of corruption arising from close relationships between the client and other contracting parties (Glagola and Sheedy, 2002) (D23).

3.8 Public Project Procurement and Management

Construction projects may be initiated by private clients or the public sector. This study focuses on public construction projects. Past studies showed that the public sector faces more challenges than private sector clients in an attempt to adopt relational transactions. This might because the project procurement and management routes in public sector are different from the private sector, like adherence to regulations and strict project delivery principles.

3.8.1 Adhere to rules and regulations

Public project procurement and management are constrained by preset rules, regulations and statute. In general, government procurement activities in Singapore are decentralized to individual ministries, departments and statutory boards (Jones, 2002). However, they must conform to central procurement guidelines issued by the Ministry of Finance (MOF). MOF is entitled to establish regulations regarding a wide scope of procurement aspects, such as the prequalification and awarding procedures or the technical specifications for procurement. The strict rules and regulations in public procurements have been devised because of the fear of cronyism and other corruption practices to which the Singapore government is resolutely opposed (Jones, 2002). Yet, the emphasis on strict rules also precludes the adoption of collaborative procurement in Singapore's public sector (Jones, 2002).

The strict adhere to rule and regulations also create an opportunity to embrace more relational transaction practices in the public sector. For example, the public sector faces enormous pressure to deliver high performance projects as tax payers' money is

involved in public projects. This pressure might force public clients to seek for various solutions to improve project outcomes. Relational transactions, advocated as an effective approach to improve project outcomes, may indicate strong interests to the public sector. This may is an opportunity to attract public clients to adopt relational transactions. In addition, the public sector may also have the advantage of disseminating the successful experience into the whole industry, which may facilitate the diffusion of relational transactions (Kumaraswamy et al., 2005).

3.8.2 Strict project delivery principles

Three principles, namely fairness, openness and competitiveness, are fundamental for Singapore government procurement policies (MOF, 2011). The key principles governing Government Procurement are: transparency; open and fair competition; and value for money (MOF, 2011).

Several measures are adopted to widen the scope for competition and to enhance transparency for the public procurement. For example, government procurements in Singapore are made through the online Government Electronic Business (GeBIZ) platform, where procurement information and documentation are publicized. The use of open competition may be because there are a limited range of local suppliers for certain goods and services, thereby expelling government procurement entities to outsource among overseas suppliers (Jones, 2002).

All government procurement of above S$70,000 must adopt tendering procedures in Singapore. Three methods are available: (i) open; (ii) selective or (iii) limited tendering procedures. Under an open tender, any supplier may participate by responding to Tender Notices. An open or selective tender will be called unless the circumstances allow for a limited tender to be called. The use of a Limited Tender has to be approved by the Permanent Secretary (for Ministries) or the CEO (for a

statutory board). A limited tender may be used in the following instances: (i) when no responsive tender is received from an earlier open or selective tender; (ii) when it concerns national security; or (iii) when it is not feasible/practical to call for open tenders (*e.g.*, because of intellectual property rights or for works of art) (GeBIZ, 2011).

Open competition for procurement contracts enables all tenders who have the capacity to provide goods and services required to compete on equal terms with each other (Jones, 2002). Owing to a limited range of suppliers available locally for certain goods and services, the public sector is impelled to out-source amongst overseas suppliers, which would be more effectively undertaken through competitive tendering (Jones, 2002).

Any construction firm wishing to undertake public projects in Singapore must register with the BCA under Contractors Registry System (CRS) (BCA, 2010). There are seven major registration categories, namely Construction Workhead (CW), Construction Related Workhead (CR), Mechanical & Electrical Workhead (ME), Maintenance Workhead (MW), Supply Head (SY), Trade Head (TR) and Regulatory Workhead (RW) (BCA, 2013a). Four requisites are essential for the registration, which are track record and performance, financial capacity, personal resources and company status with the Accounting & Corporate Regulatory Authority (BCA, 2013a). Under each category, firms are placed under "work heads" indicating the type of work they have the capability to undertake and financial grades denoting their tendering limits.

Contractors who wish to undertake both public and private construction projects need to be licensed, according to the Building Control (Amendment) Act 2007. The Licensing of Builders Scheme is part of BCA's long-term plan to upgrade the safety

and quality standards of the construction sector. The aim of licensing of builders is to raise professionalism among builders by requiring them to meet minimum standards of management, safety record and financial solvency (BCA, 2010).

Firms that wish to provide consultancy services to public works should first be emplaced on the list of Public Sector Panels of Consultants (PSPC). This list is categorized by different disciplines (*i.e.*, Architectural, Civil and Structural, Mechanical and Electrical, Quantity Surveying and Project Management) and different project cost ranges (BCA, 2013b).

Value for money does not necessarily mean that a tender must be awarded to the lowest bidder (MOF, 2011). It requires a holistic approach. A Price-Quality Method (PQM) is adopted to assess the builders in the tendering for public projects. Public clients have the flexibility to: (i) adopt a price:quality ratio of between 80:20 and 60:40 (with safety making up a minimum of 10% of the quality points); (ii) select the relevant quality attributes; and (iii) determine their relative weightings. The quality attributes comprise: (i) past and/or on-going project performance; (ii) relevant track record; and (iii) project-specific requirements.

In addition, Quality-Fee selection Method (QFM) is adopted in conjunction with the PSPC for the evaluation of building and construction consultancy tenders in the public sector (BCA, 2013b). It is primarily quality-based with a higher weightage given for quality. The Q/F weighting ranges from 60/40 to 80/20. Besides the overall quality:fee weightages, the weightages of the various quality criteria could be made known at tender stage. Quality scoring will be carried out before fee proposals are opened (BCA, 2013b).

3.9 Gaps in Knowledge

The first knowledge gap is that it is still not known whether public projects can benefit from relational transactions and close relationships (knowledge gap 1). Formal contracts contain fairly explicit stipulations of proscribed and prescribed behaviors and risk allocation (Macneil, 1978) (see Section 2.2). However, Macneil's (2000a) Relational Contracts theory and Granovetter's (1985) Network Embeddedness theory state that contracts involve relationship exchanges rather than the feature of "sharp in" and "sharp out" in the transaction. Prior studies have found that relational transactions have a positive relationships with project outcomes (*e.g.*, Rahman and Kumaraswamy, 2004a; 2012; Chinowsky *et al.*, 2008; Ling and Li, 2012). These empirical studies, yet, mainly investigated projects in general, without differentiating project types (*i.e.*, whether public or private projects). In reality, the scenario faced by contracting parties in public projects differs from that in private projects due to the characteristics of public project procurement and management (see Section 3.8). Hitherto, the research on relational transactions in public projects is still piecemeal and anecdotal.

The second knowledge gap is that it is still not known which relational transaction practices could contribute to good relationship quality (knowledge gap 2). The use of open tenders to procure services and products in public projects means that there is no guarantee for future relationships, even when partners have been embedded within the same network (see Section 3.8). The potential discontinuity in relationships may cause partners to act in an atomized manner, which is a deterrent to relationship development. However, there is little information about how to cultivate embedded networks through relational transactions in public projects.

The third knowledge gap is that it is still not known which barriers and drivers have significant impacts on the adoption of relational transactions in public projects (knowledge gap 3). Sections 3.6 and 3.7 show that the drivers of and barriers to relational transactions have been studied on construction projects in general without distinguishing between public and private projects (see Section 3.8). Hitherto, there is still little information about the drivers of and barriers to relational transactions in public projects.

The last knowledge gap is that it is still not known whether this difference in different parties' perceptions of factors motivating and deterring relational transaction in public projects is significant (knowledge gap 4). Despite the potential benefits, the public sector likely faces more difficulties in adopting relational transactions (Rahman and Kumaraswamy, 2004b). On the contrary, private parties' boundaries are more flexible and permeable, making it more suitable for close cooperation in relational transactions (Rahman and Kumaraswamy, 2004b). This might indicate that contracting parties in a public project may differ in the attitude towards the adoption of relational transactions. However, there is still little information about comparing different parties' perceptions of the factors motivating and deterring relational transactions in public projects.

In the context of Singapore, fieldwork was therefore undertaken to fill the knowledge gaps identified, which specifically investigated: (i) whether relationship quality could give rise to better project outcomes; (ii) to what extent relational transaction practices can lead to better outcomes and relationship quality; (iii) the drivers of and barriers to adopting relational transactions in public projects; and (iv) the difference in different parties' perception of factors motivating and deterring relational transactions in public projects (see Section 1.3).

3.10 Hypotheses

Based on the literature review, conceptual framework (see Figure 3.1), knowledge gap (see Section 3.9), research questions (see Section 1.2) and research objectives (see Section 1.3), the research hypotheses are set out. Table 3.7 explains the link between these.

Table 3.7: Linking research questions, objectives and knowledge gaps

Research questions (Section 1.2)	**Research objectives (Section 1.3)**	**Knowledge gap (Section 3.9)**
"Which are the factors that will significantly motivate or inhibit relational transaction practices in public projects?"	1. identify the drivers of and the barriers to adopting relational transactions in public projects;	It is not known which barriers and drivers have significant impacts on the adoption of relational transactions in public projects (knowledge gap 3).
"Do contracting parties have significantly different perceptions of the factors motivating and deterring relational transactions in public projects?"	2. compare different parties' perceptions of the factors motivating and deterring relational transactions in public projects;	It is not known whether there is significant difference in different parties' perceptions of factors motivating and deterring relational transaction in public projects (knowledge gap 4).
"Can public projects benefit from good relationships among contracting parties?"	3. examine whether relationship quality could give rise to better project outcomes;	It is not known whether public projects can benefit from relational transactions and close relationships (knowledge gap 1).
"To what extent can relational transactions contribute to better public project outcomes?"	4. explore to what extent relational transaction practices can lead to better project outcomes	It is not known whether public projects can benefit from relational transactions and close relationships (knowledge gap 1).
"Which are the relational transaction practices that can help to establish good relationships in public projects?"	4. explore to what extent relational transaction practices can lead to better relationship quality	It is not known which relational transaction practices could contribute to good relationship quality (knowledge gap 2).

To address the knowledge 1, it is hypothesized that (see Table 3.8 column 2 to 4):

> *"Public projects in which contracting parties adopt more relational transaction practices achieve significantly better outcomes than those that do not." (See* Table 3.8 column 2 to 4, *H1.1 to H8.1, H1.2 to H8.2 and H1.3 to H8.3.)*

"Public projects in which contracting parties have better relationships achieve significantly better outcomes than those that do not." (See Table 3.8 the last row, *H9.1, H9.2 and H9.3)*

Table 3.8: Hypotheses H1 to H9

Exogenous	**Cost (Y1)**	**Time (Y2)**	**Satisfaction (Y3)**	**Relationship quality (Z)**
Joint problem solving (PS)	H1.1 (+)	H1.2 (+)	H1.3 (+)	H1.4 (+)
Information sharing (IS)	H2.1 (+)	H2.2 (+)	H2.3 (+)	H2.4 (+)
Trust (TR)	H3.1 (+)	H3.2 (+)	H3.3 (+)	H3.4 (+)
Contractual solidarity (SO)	H4.1 (+)	H4.2 (+)	H4.3 (+)	H4.4 (+)
Propriety of means (PR)	H5.1 (+)	H5.2 (+)	H5.3 (+)	H5.4 (+)
Harmonization within the social matrix (HM)	H6.1 (+)	H6.2 (+)	H6.3 (+)	H6.4 (+)
Flexibility (FL)	H7.1 (+)	H7.2 (+)	H7.3 (+)	H7.4 (+)
Role integrity (RI)	H8.1 (+)	H8.2 (+)	H8.3 (+)	H8.4 (+)
Relationship quality (Z)	H9.1 (+)	H9.2 (+)	H9.3 (+)	

Note: (+) denotes the hypothesized sign.

To investigate knowledge gap 2, it is hypothesized that:

"Greater adoption of relational transaction practices leads to significantly better relationship quality among contracting parties." (see Table 3.8 column 5, *H1.4 to H8.4).*

Based on knowledge gap 3, the hypotheses are set out:

H10: there exist factors that significantly drive contracting parties to adopt relational transactions in public projects; and

H11: there exist factors that significantly impede contracting parties from adopting relational transactions in public projects.

In order to address knowledge gap 4 the hypotheses are set out:

H12: contracting parties have significantly different perceptions of the drivers of adopting relational transactions in public projects.

H13: contracting parties have significantly different perceptions of the barriers to adopting relational transactions in public projects.

3.11 Summary

This chapter centers on the establishment of the conceptual framework (see Figure 3.1) and operationalization of constructs (see Sections 3.3 to 3.7). Relational transaction practices comprise three network strategies (*i.e.*, joint problem solving (PS), information sharing (IS) and trust (TR)) and five RC related norms, namely contractual solidarity (SO), propriety of means (PR), harmonization within the social matrix (HM), role integrity (RI) and flexibility (FL) (see Section 3.3). The indicators of project outcomes derived comprise cost performance (Y_1), time performance (Y_2), quality performance (Y_{31}) and client's satisfaction (Y_{32}) (see Section 3.4). Another variable obtained is the relationship quality among contracting parties at the end of the project (Z) (see Section 3.5). Besides, nines drivers of and nine barriers to relational transactions are also incorporated in the framework (see Sections 3.6 and 3.7).

Chapter 4 Research Methods

4.1 Introduction

This chapter deals with research design, methods of data collection and data analysis techniques. A two-pronged research design was applied. Questionnaire-survey was initially applied to test hypotheses (see Sections 4.2 to 4.6), followed by interview-survey used to validate the statistical results (see Section 4.7).

4.2 Research Design

The first prong was a questionnaire survey. Given that the results regarding critical relational transaction practices, drivers and barriers are expected to be applicable to the whole population rather than to one specific project, survey is capable to achieve this. Survey could provide a quick and efficient way to obtain responses to explore particular issues (Tan, 2008). It is good at: (i) establishing the target phenomenon; (ii) detecting patterns among a huge amount of information; (iii) measuring the unique effects of factors (Babbie, 2002; Yang, 2010). The second prong of semi-structured interviews aimed to validate statistical results through qualitative data (see Section 4.7).

4.3 Data Collection Method

Questionnaire survey was administrated to professionals who have had experience in public projects, particular to public clients, private consultants and contractors. They were requested to provide data of a completed public project that they had been involved in.

The survey packages were sent out by mail (*i.e.*, postal and email). The mail package contains: (i) a cover letter to explain the purpose of the research (see Appendix 1); (ii)

a self-administrated questionnaire (see Appendix 2); and (iii) a self-addressed and stamped envelope for returning the questionnaire (only in the postal survey package). To lessen resistance to the survey and motivate people to reply, respondents could request for a summary of the findings.

Since response rate of mail survey is likely to be low, supplementary face-to-face interviews were also conducted. In order to facilitate the interviews, some strategies proposed by Babbie (2002) were adopted. These are: interviewers should be familiar with the questionnaire; they should follow question wording and record responses exactly; and they should try to probe for a response, especially when the respondents answer inappropriately (Babbie, 2002).

4.4 Data Collection Instrument

A structured questionnaire was designed as the data collection instrument. Close-ended questions can provide a uniformity of responses and are easily processed (Babbie, 2002). The complete questionnaire is shown in Appendix 2.

To enhance questionnaire content validity and reliability, a pilot study was conducted before full scale questionnaire survey. Purposive sampling method was adopted to select interviewees (Babbie, 2002). Four practitioners who had experience in public projects in Singapore were targeted. The framework and objectives of this study were first introduced and another one week time was left to them. After this, a face-to-face interview was then carried out which enabled an instant feedback on the drawbacks of the questionnaire. Four participants expressed that the questionnaire is comprehensive without ambiguous wording.

4.5 Sampling

Two possible ways were the candidates for selecting sample elements: selecting respondents who had experience in public projects before; or sampling public projects first and then approaching each party involved in the identified projects. Given the difficulties in contacting respondents from one completed case in the later way, the former approach was preferred to the latter. This approach was also used by other researchers in construction research domain (*e.g.*, Rahman and Kumaraswamy, 2004a; Chan *et al.*, 2004).

The population comprised public officials who had developed construction projects and private consultants and contractors who had designed and constructed public projects. Since there is no national registry of such official/firms, the size of the population is not known. The sampling frame for public officials was obtained from government directories categorized under estate development, planning and engineering. As the number of people in this group is not likely to be overwhelming, questionnaires were sent to all identified public officials.

The sampling frames for private consultants and contractors were obtained from the respective professional and trade institutions. Architects, engineers, and quantity surveyors (QS) were randomly selected from the directories of the Singapore Institute of Architects, Association of Consulting Engineers Singapore, and Singapore Institute of Surveyors and Valuers, respectively. Contractors were randomly selected from the BCA's database of Registered Contractors and Licensed Builders.

The reason for adopting random sampling is that it enables each element to have an equal chance of selection independent of any other event (Babbie, 2002). This probability sampling could ensure that a sample of individuals from the sample frame

is likely to contain essentially the same variations that exist in the sample frame (Babbie, 2002).

Probability sampling needs a good sampling frame. It would be ideal if every case to be studied is included in the list and all ineligible cases are excluded (Yang, 2010). As the private group included those who have not handled public projects before, the questionnaire clearly stated that only those who had completed public projects should fill up the questionnaire. It is worth noting that this study was not to investigate the projects which adopted an arrangement called relational transactions, but to probe into the extent to which relational transactions practices (see Sections 2.3.3 and 2.4.4) were implemented in public projects.

Snowball sampling was adopted when conducting the face-to-face interviews. The selection of snowball sampling was because the introduction by acquaintances would remove respondents' concerns and help to enhance response rate. However, it is worth noting that snowball sampling is a non-random means of obtaining samples, which may involve biases. Hence, the samples should be scrutinized and the data test for bias (Fellows and Liu, 2003).

4.6 Data Analysis Techniques

Data analysis began with the *t* test, followed by the Exploratory Factor Analysis (EFA) which aimed to extract latent factors from the significant drivers (C) of and barriers (D) to relational transactions. To test the hypothetical relationships among relational transactions (X), relationship quality (Z) and project outcomes (Y), Partial Least Squares-Structural Equation Modeling (PLS-SEM) was adopted. Prior to such three-step analysis, characteristics of the sample were first illustrated.

4.6.1 Assumptions of measurement scales and statistical techniques

Owing to a debate over whether ordinal data can work with parametric methods, Jakobsson (2004) suggested examining the assumptions of the measurement scales and candidate statistical methods before carrying out statistical analysis.

Three types of measurement scales are presented in the questionnaire: (i) nominal; (ii) interval; and (iii) ordinal scales. Nominal data consist of the number of observations that fall into specific categories and the categories are mutually exclusive (Roscoe, 1975). An example that requests for nominal data is question A1 asking about the type of the facility (*e.g.*, public housing, school and hospital). For interval data, the magnitude between each two adjacent values is assumed to be equal (Roscoe, 1975). Examples of interval data are "construction cost in dollars" and "project duration in months".

The ordinal scale is used to measure direction (by agree/disagree) and intensity (by strongly or not) of attitude (Albaum, 1997). It is worth noting that: the distance between these ordered categories is unknown; and these ordered categories could denote respondents' attitude which is continuous in nature (Winship and Mare, 1984). Questions designed with the use of ordinal scales are the 5-point Likert scales in Sections C and D. The anchors for the Likert item in Section B are: 1=very Low; 3=neutral; and 5=very High. The Likert items in Section C and D are anchored as: 1=strongly disagree; 3=neither; and 5=strongly agree.

Ordinal scales are distinguished from nominal scales by the additional property of orders among the categories (Roscoe, 1975) and differ from interval data by following a monotonic transformation (O'Brien, 1983). Interval data on the contrary are subject to a linear transformation (O'Brien, 1983). They follow different

transformations because the distance between two adjacent scores on an ordinal scale is assumed to be unknown, whereas interval data assume an equal distance (Harwell and Gatti, 2001; Jakobsson, 2004; Corder and Foreman, 2008).

Past studies debated on the adequacy of performing parametric methods on ordinal data (*e.g.*, Jakobsson, 2004; Allen and Seaman, 2007). The opponents claimed that the selection of statistical methods is constrained by the scale type (*e.g*., Forrest and Andersen, 1986; Velleman and Wilkinson, 1993; Fellows, and Liu, 2003; Jakobsson, 2004). In the strictest propriety, parametric methods would be invalid when data are on an ordinal scale (*e.g.*, Forrest and Andersen, 1986; Fellows, and Liu, 2003; Jakobsson, 2004). This is because the assumptions of parametric methods are rarely met by ordinal data. If the assumptions required by a parametric test, for instance, cannot be reasonably met, the parametric test could be worthless (Jakobsson, 2004). The results would be invalid or distorted. Another explanation is the interpretation of data meaningfulness. It is claimed that linear transformation is admissible for interval data, while it does not hold for ordinal data (Knapp, 1990).

Another stream of studies, however, argued that statistical methods are not supposed to hold hostage to measurement scales (*e.g*., Labovitz, 1971; Harwell and Gatti, 2001). The meaningfulness of using the mean rather than the median on an ordinal scale is a measurement problem (Armstrong, 1981). The selection of data analysis techniques, on the other hand, is a statistical issue. In fact, the meaningfulness of the scale and appropriateness of a parametric statistic method are separate considerations (Armstrong, 1981).

Despite this argument, there seems a preference for using parametric methods on ordinal data in applied fields because of the following reasons: (i) parametric methods are normally more powerful than nonparametric alternatives (Norman, 2011); (ii)

conclusions and interpretations of parametric methods might be considered easier and provide more information (Allen and Seaman, 2007); (iii) while Likert items may be ordinal, Likert scales consisting of sums across several measurements are interval (Likert, 1932; Carifio and Perla, 2008); (iv) the results from parametric tests with ordinal data are reasonably reliable (*e.g.*, Nunnally, 1975; Carifio and Perla, 2008; Norman, 2011); and (v) parametric methods incorporate many modern statistical methods, like factor analysis, hierarchical linear moderns and structural equation modeling, which are rare for nonparametric methods (Norman, 2011).

Some researchers argued that it seems to matter very little even when assumptions are violated (Armstrong, 1980; Norman, 2011). Stevens (1968:856) also admitted that "the widespread use on ordinal scales of statistics appropriate only to interval or ratio scales can be said to violate a technical canon, but in many instances the outcome has demonstrable utility". Parametric statistics can be used with ordinal data, with small sample sizes, with unequal variances and with non-normal distributions, with no fear of ''coming to the wrong conclusion'' (Norman, 2011:632). "There is no need to replace parametric statistical tests by nonparametric methods when the scale of measurement is ordinal and not interval" (Zumbo and Zimmerman, 1993:390). The opponents against the use of parametric statistics with ordinal data is: "(i) not sound theoretically; (ii) not necessary empirically; and (iii) can have negative consequences if needlessly followed" (Armstrong, 1980:62).

Overall, using parametric methods appears tenable. Instead of the sole reliance on parametric methods, the results drawn from quantitative data analysis should be read with cautions. Stevens (1946) indicated that "when only the rank-order of data is known, we should proceed cautiously with our statistics, and especially with the conclusions we draw from them". One strategy to avoid pitfalls and to obtain reliable

and valid results of data analysis is to make use of a profound exploration and knowledge of the data (Schoder *et al.*, 2006).

With the these considerations in mind, three strategies were adopted during the quantitative data analysis stage: (i) assumptions of each adopted statistical method were examined with care; (ii) results from quantitative analysis were first compared with previous findings; and (iii) then validated by qualitative information.

4.6.2 Statistical tests of significance

After the data were collected, the one sample t-test with a significance level set at 0.05 was undertaken against a test value of 3 (center value on a 1-5-point scale) to find out whether each indicator is significantly important for the whole sample. The indicators comprise outcomes (Y), relationship quality (Z), relational transaction practices (X), drivers (C) and barriers (D). Besides, the one sample t-test was also carried out for individual group of public clients (CL), private sector contractors (CT) and consultants (CS) when examining drivers and barriers. The null hypothesis H_0 is that the indicator is not important. If $p<0.05$ and t value is positive, the decision is to reject H_0 and accept H_1. It is then concluded that the population would regard the indicator to be significantly important (*i.e.*, drivers (C) and barriers (D)) or the relational transaction practices (X) are implemented to s significant extent.

In order to find out whether different groups have different perceptions of the relative importance of drivers (C) and barriers (D) and different parties implemented relational transaction practices (X) to a different level, the unpaired *t* test at the 95% confidence level was carried out between each two groups of respondents (*i.e.*, CL-CT, CL-CS and CS-CT). The null hypothesis (H_0) is that the two groups of respondents have significantly similar perceptions toward certain indicator. If $p<0.05$,

the decision is to accept H_1 and reject H_0. To accept H_1 for a specific indicator is to conclude that respondents from different groups had significantly different perceptions of that indicator (*i.e.,* drivers (C) and barriers (D)) or different parties implemented relational transactions practices (X) to a significantly different level.

4.6.3 Exploratory factor analysis (EFA)

4.6.3.1 Purpose of using EFA

Given a lack of strong theories about the number and nature of the underlying factors pertaining to the drivers (C) of and barriers (C) to relational transactions and outcome indicators and relationship quality (*i.e.,* Y and Z), EFA was performed. EFA as an exploratory method has advantages of generating theories (Conway and Huffcutt, 2003) and arriving at more parsimonious understanding of a set of measurement items (Fabrigar *et al.,* 1999). Prior to operating EFA, it postulated that the relationship between the measurement items and the derived factors are linear and the ordinal data approximate continuous data.

4.6.3.2 Procedures of conducting EFA

Performing EFA comprises five stages, namely data preparation, extraction, factor retention, rotation and evaluation. Tabachnick and Fidell (1996:636) stated that "one of the problems with factor analysis is that there is no criterion variable against which to test the solution". The interpretation of results at each stage mainly centers on a series of subjective judgments. The critical parameters are elaborated below.

One critical step was to check whether the data set could meet the requirements to carry out EFA. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was examined. The KMO value would be greater than 0.5 when there is an adequacy of the sample size (Field, 2000). Another parameter is the value of the elements on the

diagonal of this matrix. Based on an anti-image matrix of covariance and correlation, these elements should be greater than 0.5 if the sample is adequate (Field, 2000). Lastly, the extent to which the measurement items correlated was examined by using Bartlett's test of spherity, which "tests the null hypothesis that the original correlation matrix is an identity matrix" (Field 2000: 457). When the correlation matrix is an identity matrix, there would be no correlations between the measurement items. There is no multicollinearity if the determinant is greater than 0.00001 (Field, 2000).

Another critical step was to evaluate the results through assessing: (i) communality value; (ii) factor loading; (iii) reliability (*i.e., Cronbach's alpha* coefficients and item-total correlation scores). Communality values in social science domain usually range from 0.4 to 0.7 (Costello and Osborne, 2005). If an item has a communality value less than 0.4, it may either not be related to the other items, or suggest an additional factor that should be explored (Costello and Osborne, 2005).

Factor loadings of 0.45~0.54, 0.55~0.62, 0.63~0.7 and >0.7 are considered as fair, good, very good and excellent respectively (Comrey, 1973). In addition, it is worth noting that a factor with fewer than three items is generally weak and unstable; then a factor loading of 0.5 or more are desirable (Costello and Osborne, 2005).

Measurement reliability was examined through the *Cronbach's alpha* and item-to-total correlation. Measurement items with low Cronbach's alpha coefficients (<0.7) and low item-total correlation (<0.3) were candidates for removal (Nunnally, 1978). A high *alpha* coefficient indicates that the measurement items of a construct are highly correlated, and vice versa (Pedhazur and Schmelkin, 1991). Item-to-total correlation was used to identify inconsistent measurement items in each factor; and the inconsistent items should be eliminated if the removal may considerably increase the *Cronbach's alpha* coefficient of the factor.

Overall, measurement items exhibiting low communality value (<0.4), low factor loadings (<0.45), low item-total correlation (<0.3), contributing to a low *Cronbach's alpha* coefficient (<0.7) were candidates for elimination (Comrey, 1973; Nunnally, 1978; Costello and Osborne, 2005).

4.6.4 Partial Least Squares-Structural Equation Modeling (PLS-SEM)

4.6.4.1 Purpose of using PLS-SEM

In order to detect the relationship among relational transactions (X), relationship quality (Z) and project outcomes (Y), PLS-SEM was adopted. The result of PLS-SEM comprises a set of measurement models and a structural model. The measurement model deals with the relations between measurement items and the respective latent construct; the structural models deal with the relations among latent constructs.

The preference of PLS-SEM was also attributed to its advantage of: identifying key driving constructs or theory development (Hair *et al.*, 2011; 2012); dealing with non-normality data set (Hair *et al.*, 2011; 2012; Ringle *et al.*, 2009); applicability for formative mode (Hair *et al.*, 2011; 2012; Ringle *et al.*, 2009); and minimum demand for sample size (Reinartz *et al.*, 2009).

4.6.4.2 Procedures of PLS-SEM

The steps consist of: (i) examining data characteristics, like sample size and distribution of the data set; (ii) specifying the measurement models and structural model; and (iii) evaluating the results. Since the estimation is undertaken by the selected software SmartPLS (Ringle *et al.*, 2005), the specific algorithm is not presented. Instead, Hair *et al.* (2011) suggested that parameters settings for the software are more important to report.

(i) Data characteristics

This stage mainly examined the characteristics of sample size and data distribution. Since SEM-PLS is capable to handle highly skewed distribution, there are no distributional requirements (Fornell and Bookstein 1982; Ringle *et al.* 2009; Hair *et al.*, 2011; 2012). In addition, PLS-SEM is also able to reach robust results when sample size is small, even as low as 20, as indicated by Chin and Newsted's (1999) Monte Carlo simulation result.

If the sample is small, two remedy measures could be undertaken: increasing the number of measurement items or choosing measurement items with higher loadings (Reinartz *et al.*, 2009). With these in mind, this study prioritized to using multiple measurement items and accepted a relatively high threshold value. In addition, properties of measurement models and the property of missing data were examined. It was also presumed that ordinal data approximate to be continuous and the construct is a linear combination of the measurement items.

(ii) Model specification

Model specification refers to the process to build measurement models and the structural model. The structural model specification was examined at length in the framework building stage (see Section 3.2); and the theoretical underpinnings make it tenable. Major concerns stem from the measurement model specification due to an argument of using formative or reflective modes. The following section thus aimed to elaborate this argument.

Table 4.1 shows the criteria used to determine the mode of measurement models and one example is depicted in Figure 4.1. The typical distinction between reflective and formative mode is the underlining relationship between the construct and

measurement items. Reflective modes indicate causality from constructs to measurement items, whereas formative modes show otherwise. Another critical criterion is whether the measurement items are correlated. For formative mode, it is not essential for one scale of measurement items to be highly correlated, whereas the measurement items in a reflective mode are supposed to have a high level of correlation. As exampled in Figure 4.1, the correlation among measurement items and causality between constructs and measurement items are apparently distinguished from each other.

Table 4.1: Comparison between reflective and formative modes

Reflective mode	**Formative mode**
Latent construct is existing, the realist interpretation of a latent construct	Latent construct is formed, constructivist, operationalist, or instrumentalist interpretations
Causality from constructs to indicators	Causality from indicators to constructs
Indicators are manifested by the construct; they are interchangeable, share a common theme; dropping an indicator does not alter the meaning of the construct	Indicators define the construct; they need not share a common theme; they are not interchangeable; dropping an indicator may alter the meaning of the construct
Measures have high correlation, as they are all dependent on the same unobservable variable	Measures have positive, negative, or zero correlation with one another
Measures have similar sign and significance of relationships with the antecedents/consequences as the construct	Measures may not have similar significance of relationships with the antecedents/consequences as the construct
Taking measurement error into account at the measure level; error term in indicators can be identified	Take measurement error into account at the construct level; error term cannot be identified if the formative measurement model is estimated in isolation

(Source: Chin, 1998; Hulland, 1999; Jarvis *et al.*, 2003; Borsboom, 2005; Coltman *et al.*, 2008)

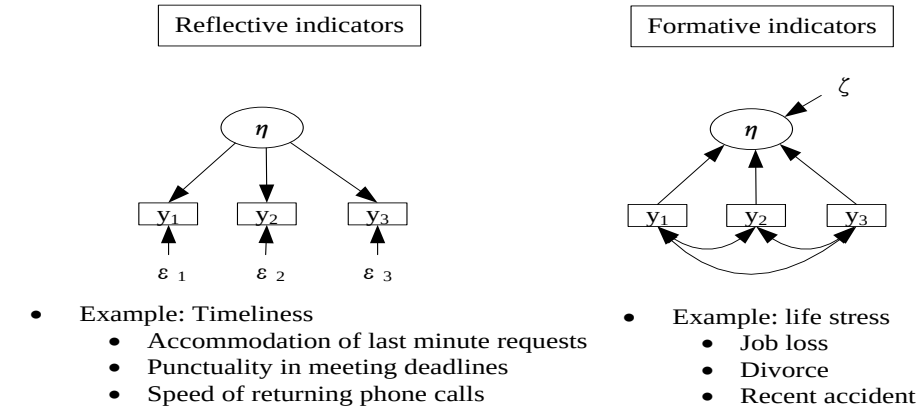


Figure 4.1: Reflective versus formative indicators
(Source: Haenlein and Kaplan, 2004)

Relational transaction practices in this study were classified into three groups (see Section 3.2). The first two groups reported the relational transactions exercised by individuals or bilateral parties. Regarding the model specification, it was common to collapse three parties' practices into a one-dimensional construct, like using three parties' practices to measure one construct. However, Petter *et al.* (2007) noted that this approach should be carried out with cautions, because the construct measured by three parties' practices in fact composes of several different aspects. Collapsing them into one-dimensional construct would adversely impact the construct validity as the construct itself is not uni-dimensional (Petter *et al.*, 2007).

Alternatively, hierarchical constructs distinguished from single dimension constructs can be manifested by multiple dimensions (Netemeyer *et al.*, 2003). For example, the construct "role integrity (RI)" can be measured by three dimensions (*i.e.*, RI-CL, RI-CS and RI-CT). Each party's role integrity was further manifested by a scale of measurement items. Another reason of preference to hierarchical constructs is its ability to keep theoretical parsimony. For example, if the construct of each party's role integrity (*i.e.*, RI-CL, RI-CS and RI-CT) was directly related to the outcomes, it would generate a too complex model. Instead, using a hierarchical construct where the second order construct "role integrity (RI)" linked to the outcomes allowed for more theoretical parsimony and reduced model complexity (Edwards 2001).

Given that there are two types of measurement modes (*i.e.*, reflective and formative mode), four types of hierarchical modes are identifiable. These are formative–reflective, formative-formative, reflective-formative and reflective-reflective (Ring *et al.*, 2012). Criteria used to identify the first and second order mode are as same as that adopted in defining measurement modes (see Table 4.1).

The conceptualization of a hierarchical model in PLS-SEM was processed through repeating the measurement items (Tenenhaus *et al.*, 2005). For instance, the measurement items of first order construct "RI-CT", "RI-CS" and "RI-CL" were re-specified to the second order construct "Role integrity (RI)". In this manner, the measurement items were used twice: first for the first-order construct; and second for the second-order construct (Wetzels *et al.*, 2009). An example is shown in Figure 7.1 in Section 7.2.

(iii) Evaluating results

This stage aimed to evaluate the measurement, hierarchical and structural models. Regarding evaluating reflective measurement models, four parameters were examined: (i) internal consistency reliability; (ii) indicator reliability; (iii) convergent validity; and (iv) discriminating validity (Hair *et al.*, 2011; 2012).

In order to assess internal consistency reliability, composite reliability (CR) was adopted. It prioritizes measurements according their reliability during model estimation rather than assuming that all measurements are equally reliable, making it suitable for PLS-SEM (Hair *et al.*, 2011). The threshold value of 0.7 was adopted (Bagozzi and Yi, 1988).

With respect to indicator reliability, Churchill (1979) suggested that the measurements with a loading smaller than 0.4 could be eliminated. For the measurements with loadings between 0.40 and 0.70, a removal from the scale could be taken into account if the deletion could lead to an increase in composite reliability above the threshold value (Hair *et al.*, 2011). Notwithstanding this, weaker measurements (loadings<0.7) were sometimes retained because of their contribution to content validity (Hair *et al.*, 2011).

For convergent validity, the average variance extracted (AVE) should be higher than 0.5 (Bagozzi and Yi, 1988; Hair *et al.*, 2011). For discriminating validity, the AVE of each construct should be higher than the construct's highest squared correlation with any other latent construct (Fornell-Larcker criterion) or, measurement item's loading should be higher than all of its cross loadings (Cenfetelli and Bassellier 2009; Hair *et al.*, 2011).

When assessing hierarchical model assessment, Bollen and Lennox (1991) suggested testing sub-dimension validity by examining whether each first order construct is significantly related to the second-order construct. This could be achieved by estimating the significance of their weights. Furthermore, the weights could be used to assess the relative impact of the first-order constructs on the second-order constructs (Wetzels *et al.*, 2009). When assessing the significance of the weights, MacKenzie *et al.* (2011) noted that it is rare to drop an entire sub-dimension without eliminating an essential aspect of the construct. It is because "reliability is not an issue of debate when a multidimensional construct and its dimensions are treated as latent variables that contain no measurement error" (Edwards, 2001:160).

The structural model results were evaluated by using coefficient of determination (R^2) (Chin, 1998; Hair *et al.*, 2011), path coefficients (Chin 1998; Henseler *et al.*, 2009) and predictive relevance through the Stone-Geiser Q^2 test (Stone, 1974; Geiser, 1975).

The judgment of what R^2 level is appropriate depends on the specific research discipline (Hair *et al*., 2011). Falk and Miller (1992) suggested that the value of R^2 more than 0.1 is acceptable. In construction research, many studies did not report the R^2 value if SEM is mainly used to test hypotheses rather than making prediction, like

Eriksson and Pesämaa (2007), Jin *et al*. (2007), Wong *et al.* (2008), Doloi (2009) and Maurer (2010).

The significance of path coefficients was calculated with the aid of bootstrapping (Gefen *et al.* 2000; Henseler *et al.,* 2009). Bootstrapping is a re-sampling procedure in which the original sample serves as the population. An empirical sampling distribution can be relied upon to describe the actual distribution of the population on which the parameter estimates are based (Brown, 2006). Critical t-values for a two-tailed test are 1.65 (significance level = 10 percent), 1.96 (significance level = 5 percent), and 2.58 (significance level = 1 percent).

Stone-Geisser's Q^2 was adopted to assess predictive relevance (Stone, 1974; Geisser, 1975). A value of Q^2 greater than zero is indicative of predictive relevance (Tenenhuas *et al.*, 2005). Q^2 can assess an individual construct's predictive relevance for the model by omitting selected structural relationships (Hair *et al.,* 2011; 2012). It is a kind of cross-validated R^2 between indicators of an endogenous latent constructs and all indicators associated with the latent constructs explaining the endogenous latent constructs, using the estimated structural model (Tenenhuas *et al.*, 2005). The technique represents a synthesis of function fitting and cross-validation (Henseler *et al.*, 2009).

4.7 Research Methods in Validation Phase

To validate statistical results, the second prong of semi-structured interviews was adopted using qualitative data. The selection of semi-structured interviews is because: qualitative research can inform theory and model development (Connolly, 1998); and it could offset the weakness of the statistical results. For example, the instrument for semi-structured interviews could form the "how" and "why" questions, which are

rarely widely applied in questionnaire-survey. A mix of methods would be thus more effective to triangulate the findings.

4.7.1 Sampling interviewees

The population comprised the professionals who have had experience in public projects before. The sample frame at this stage was similar to that of questionnaire survey (see Section 4.5). Snowball sampling was used to target participants. It began with a few respondents who are the acquaintance of the interviewer. They were requested to provide referrals for additional respondents (Tan, 2008). The interviewees involved in this stage were those who did not participate in the phase one of the study.

4.7.2 Data collection methods

Semi-structured interviews were adopted to collect data because it could ensure sufficient qualitative data to triangulate the findings. Other advantages include: (i) it is more flexible and practical to probe into the underlying motives of a particular phenomenon; (ii) direct contacts with interviewees enables instant observation of interviewees' attitude towards certain issues; (iii) it allows instant clarification of ambiguities and thus enhances the reliability of information obtained; and (iv) it enables rapport-building with interviewees (Noor, 2008).

However, one disadvantage of face-to-face interviews is that interviewees might modify their behaviors in a variety of ways, such as modifying their speech and behaviors to appear more respectable (Babbie, 2002). To address this disadvantage, the following steps were taken (Robson, 2002): (i) interviewees were encouraged to talk freely and openly without interruption; (ii) interview questions were formulated in a straightforward and non-aggressive manner in order to minimize the possibilities

that interviewees become confused and defensive; and (iii) interview questions were formulated in a neutral manner so as to eliminate cues that might lead interviewees to respond in a particular way. These measures improve the reliability and validity of interview findings. Interviews were digitally recorded, if interviewees allowed it. To motivate the interviewees, a summary of the main findings was promised to them.

4.7.3 Data instruments for interviews

Semi-structured questions regarding the appropriateness of the statistical results were designed. The interview questions were developed from the survey result (see Appendix 3). The questions were piloted with one practitioner in Singapore, which aimed to identify ambiguities and help to clarify the wording of the questions.

4.7.4 Qualitative data analysis

Thematic analysis was adopted whereby the data was analyzed according to the different themes (Creswell, 2009). The theme of this study was the significant paths identified in the statistical results. Coding guided by the interview questions was adopted (Neuman, 2007). Through the coding process, a large amount of data could be organized into smaller segments as a means of reduction and simplification (Bailey, 2006). The grouped data were given a label to aid in discussion of how they might be important to the understanding of a setting (Bailey, 2006).

4.8 Summary

A two-pronged research design was devised to test the conceptual framework. Questionnaire-survey was initially conducted (see Section 4.2). During this process, mails were sent out to the randomly selected samples (see Section 4.5). It was complemented by face-to-face interviews using snowball sampling method. After the data was collected, three data analysis techniques, namely t test, EFA and PLS-SEM,

were adopted (see Section 4.6). To validate the survey findings, a second prong of interview-survey was conducted and data was collected via semi-structured interviews (see Section 4.7); the snow sampling was adopted to select participants.

Chapter 5 Survey Results

5.1 Introduction

1440 survey packages were sent out between 13 June and 30 November, 2011. Of these, 104 responses were received with varying degrees of completeness, giving a response rate of 7.2%. It is acknowledged that the sample size is relatively small. This is because Singapore is a small country with about 4 million citizens and hence correspondingly, the samples are limited. Notwithstanding this, one sample t test and factor analysis could still be performed because in accordance with the generally accepted rule, central limit theorem holds true when the sample size is no less than 30 (Ott and Longnecker, 2001). It is also acknowledged that the response rate is low. This may be because survey packages were sent to a mix bag of consultants and contractors who had and have not handled public projects (see Section 4.5). As those who have not handled public projects were instructed not to fill up the questionnaire, they dropped out of the study, thereby causing the response rate to be low. While the low response rate may cause some bias in the responses, a check of the returned questionnaires showed that respondents have rated on a wide range of the scale and ratings were not skewed. The following data analyses are based on such returns. Owing to missing data, the response number of some questions is less than 104.

5.2 Missing Data Analysis

Missing data is not uncommon in research data sets. The approach to deal with them was based on the randomness of the missing data (Little and Rubin, 1986). In order to detect the pattern of missing data on the measurement items, Little and Rubin's (1986) Missing Completely at Random (MCAR) test was performed whereby the pattern of the current data set could be compared with the pattern that is expected for a random missing data. If the differences are not significant, the missing data can then be

treated as MCAR (Hair *et al.*, 1998). By contrast, if the pattern of missing data is related to the observed data, it is called Missing at Random (MAR) (Hair *et al.*, 1998).

The result of MCAR test in Table 5.1 does not show a significant difference, indicating that the pattern of missing values does not depend on value. Therefore, listwise, pairwise and regression estimation are permitted in the course of data analysis (Little and Rubin, 1987).

Table 5.1: Results of Little's MCAR test

Section	Chi-Square	Df	Sig.	Result
Drivers	116.290	110	.322	MCAR
Practices	2169.945	2248	.879	MCAR
Barriers	161.465	189	.927	MCAR
Performance	81.262	72	.213	MCAR

5.3 Profiles of Respondents

Table 5.2 shows that more than half of the respondents are in management level with designations like directors, general managers and senior contract managers. Within the professional category, many of them are senior QS and senior resident engineers. The respondents' mean number of years of experience in the construction industry is 16.1, with a standard deviation of 10.3, indicating that respondents were experienced.

Table 5.2: Profiles of respondents

Descriptions	Number	Percentage
Respondents' designations		
Top managers (*e.g.*, directors, general managers)	30	30.3
Middle managers (*e.g.*, project managers)	28	28.2
Professionals (*e.g.*, engineers, QS)	41	41.4
Total	99	100
Years of experience		
<5	24	24
6-15	27	27
16-25	31	31
>26	18	18

Descriptions	Number	Percentage
Total	100	100
Mean		16.1
Std. D		10.3
Minimum		2
Maximum		42

Note: owing to missing data, the response number of some questions is less than 104

5.4 Profiles of Respondents' Firms

Table 5.3 shows that there are nearly same proportions of contractors, consultancy firms and government entities, being 32%, 39% and 28% respectively. This composition could ensure an equal consideration of three parties' perceptions.

Over half are private owned and 39% are owned by public firms or organizations. The mean number of workforce of respondents' firm is nearly 2179 and the majority of respondents' firms (63.5%) have less than 1500 staff, indicating that the results would be more applicable to medium sized organizations.

Table 5.3: Profiles of firms

Descriptions	Number	Percentage
Organization type		
Consultancy firm (e.g., QS, architecture firm)	41	39.8
Contractor	33	32.2
Government entity	29	28.2
Total	103	100
Ownership of organization		
Private	61	59.2
Public	40	39.8
Public-Private JV	1	1.0
Total	103	100
Workforce		
<100	16	16.8
100-500	34	35.8
600-1500	14	14.7
> 1500	31	32.6
Total	95	100
Mean		2178.7
Std. D		4506.6
Minimum		5
Maximum		28000

Note: owing to missing data, the response number of some questions is less than 104

5.5 Profiles of Projects

5.5.1 Type of facility

Table 5.4 shows that respondents reported a spread of public projects. 45.9% are infrastructures; the rest are building projects and plants.

Table 5.4: Profiles of projects

Descriptions	**Frequency**	**Percentage**
Type of facility		
Infrastructure (*e.g.*, MRT, road, bridge)	45	45.9
Public Housing	24	24.5
School	12	12.3
Plant (*e.g.*, water, chemical plant)	10	10.2
Other buildings	7	7.1
Total	98	100.0
Types of client		
Ongoing client	71	68.3
On-off client	24	23.1
One-off client	8	7.7
Total	103	100.0

Note: owing to missing data, the response number of some questions is less than 104

5.5.2 Types of clients

Table 5.4 also shows that the majority of the clients (68.3%) undertake project development on an ongoing basis. This suggests that private consultants and contractors have future cooperation opportunities with their public partners.

5.5.3 Procurement of main contractors and lead consultants' services

Table 5.5 illustrates that open competitive bidding was the main method used to select main contractors (87.6%). The use of competitive tendering indicates that there is no guarantee of future cooperation. The price/non-price ratio in Table 5.5 indicates that price was still the most influential factor to select main contractors in public projects.

Table 5.5: Methods for procuring construction services

Descriptions	Frequency	Percentage
Bidding method for selection of main contractors		
Open competitive bidding	85	87.6
Selective bidding	10	10.3
Negotiation	2	2.1
Total	97	100.0
Price/non-price ratio		
20:80	14	17.5
30:70	10	12.5
35:65	1	1.3
40:60	6	7.5
50:50	2	2.6
60:40	6	7.5
70:30	9	11.3
80:20	25	31.3
90:10	2	2.6
100:0	5	6.3
Total	80	100

Note: owing to missing data, the response number of some questions is less than 104

The main method to select lead consultants was also open competitive bidding, accounting for 49.5%, followed by using government in-house professionals (24.1%) (see Table 5.6). Unlike the critical role of price in selecting main contractors, non-price factors were given more consideration when evaluating lead consultants. In 64% of the projects, non-price criteria were given more weights than the price criterion.

Table 5.6: Methods for procuring consultancy services

Descriptions	Frequency	Percentage
Biding method for selection of main consultants		
Open competitive bidding	45	49.5
Government in-house consultant	22	24.1
Selective bidding	16	17.6
Negotiation	6	6.6
Total	91	100.0
Price/non-price ratio		
20:80	11	25.0
30:70	8	18.2
40:60	9	20.5
50:50	6	13.6
60:40	4	9.1
70:30	4	9.1
80:20	2	4.5
Total	44	100

Note: owing to missing data, the response number of some questions is less than 104

5.5.4 Contractual arrangement

Table 5.7 provides that over half used traditional DBB with lump sum and 83.2% respondents indicated that their projects used PSSCOC or modified PSSCOC.

Table 5.7: Contractual arrangement

Description	**Number**	**Percentage**
Contractual arrangement		
Traditional DBB with lump sum	58	63.7
Traditional DBB with bills of quantities	17	18.7
Design and Build	16	17.6
Total	91	100.0
Form of contract		
PSSCOC	69	72.6
Modified PSSCOC	10	10.6
SIA	8	8.4
FIDIC	8	8.4
Total	95	100.0

Note: owing to missing data, the response number of some questions is less than 104

5.5.5 Complexity of projects

The results in Table 5.8 show that respondents agreed that the projects they participated in are significantly complex ($p<0.05$, t-value>0). A high level of project complexity might indicate more difficulties in managing time and cost.

Table 5.8: Project complexity

Descriptions	**Mean**	**Std.**	**t-value**	**Sig**
Level of integration required	3.88	.840	10.744	.000
Level of construction complexity	3.81	.893	9.223	.000
Level of specialization required	3.77	.791	9.916	.000
Level of design complexity	3.72	.960	7.661	.000
Level of technological advancement	3.39	.918	4.379	.000

Table 5.9 illustrates the cost and time metrics of the investigated projects. The results show that 80% of the projects cost more than S$50 million and almost 2/3 of the projects had a planned duration of more than 24 months, indicating that there were sufficient opportunities for relationships to develop in these projects.

Table 5.9: Construction cost and duration

Description	Number	Percentage	Cumulative percentage
Cost (Million)			
1≤Cost<50	21	21	21.0
50≤Cost<100	26	26	47.0
100≤Cost<250	26	26	73.0
250≤Cost<500	19	19	92.0
Cost≥500	8	8	100.0
Mean			314.12
Std. D			1022.96
Minimum			1.00
Maximum			10000.00
Duration (Month)			
9≤Duration<24	37	36.3	36.3
24≤ Duration <36	30	29.4	65.7
36≤ Duration <48	10	9.8	75.5
Duration ≥48	25	24.5	100.0
Mean			34.92
Std. D			16.93
Minimum			9.00
Maximum			76.00

5.5.6 Project outcomes and relationship quality

The formula to calculate time and cost performance is given below:

Time performance = (Actual project duration – Planned project duration)/ Planned project duration x 100%

Cost performance = (Final construction cost – Original contract sum)/ Original contract sum x 100%

By definition of the formula above, negative values indicate good time and cost outcomes while positive values means delays and cost overruns, and zero indicates planned and actual performance are the same.

Table 5.10 shows that both time and cost performance is poor. Nearly two third projects suffered from a cost overrun, compared to 25.6% projects with cost savings and 9.3% projects just fulfilled their cost objectives. Besides, in contrast to 46.1% projects reached time objectives, more than half of the projects were delayed.

Table 5.10: Time and cost outcomes

Categories	Frequency	Percentage	Cumulative percentage
Cost performance			
Cost variation < -10%	5	5.8	5.8
-10% ≤ Cost variation < 0%	17	19.8	25.6
Cost variation = 0%	8	9.3	34.9

Categories	Frequency	Percentage	Cumulative percentage
0% < Cost variation ≤ +5%	27	31.4	66.3
+5% < Cost variation ≤ +10%	14	16.3	82.6
Cost variation > +10%	15	17.4	100.0
Time performance			
Time variation < -10%	2	2.3	2.3
-10% ≤ Time variation < 0%	5	5.6	7.9
Time variation = 0%	34	38.2	46.1
0% < Time variation ≤ +10%	13	14.6	60.7
+10% < Time variation ≤ +20%	18	20.2	80.9
Time variation > +20%	17	19.1	100.0

Note: + denotes a cost or schedule overrun

Table 5.11 presents the detailed project outcome information. The mean project time and cost overrun is 9.89% and 5.43% respectively. The t-test results show that cost and time overrun are significantly more than 0%, suggesting poor performance. This result indicates urgencies that public sector should propose and implement more effective means to improve the time and cost performance. The quality performance and client satisfaction, relationship quality at the end of the project are seen to be significantly good ($p<0.05$, t-value>0).

Table 5.11: *t* test of project outcomes

Descriptions	Mean	Std.	t-value	Sig.
Time and cost performance				
Cost variation (%)	5.43	12.75	3.95	.000
Time variation (%)	9.89	15.09	6.18	.000
Project quality and satisfaction				
Product/output quality	3.99	.675	14.953	.000
Client Satisfaction	3.90	.679	13.495	.000
Relationship quality				
Relationship between CL&CT at the end	3.67	.894	7.456	.000
Relationship between CS&CT at the end	3.46	.936	4.881	.000
Relationship between CL&CS at the end	3.73	.852	8.386	.000

Note: + denotes a cost or schedule overrun

5.6 Summary

104 of the 1440 survey packages were received, giving a response rate of 7.2% (see Section 5.1). The profile of the respondents indicates that most of them were experienced. The results of the survey would be more applicable to medium sized organizations. A spread of public projects was investigated, which were significantly

complex. The majority of the clients undertake project development on an ongoing basis; the public clients mainly adopted open competitive bidding to select main contractors and lead consultants; and nearly two thirds suffered from cost overrun and more than half were delayed (see Section 5.5).

Chapter 6 Drivers of and Barriers to Relational Transactions

6.1 Introduction

Objectives one and two of this study are to identify the drivers of and the barriers to adopting relational transactions and to compare different parties' perceptions of the factors motivating and deterring relational transactions in public projects respectively (see Section 1.3). This chapter reports: the identification of the critical drivers (see Section 6.2.1) and barriers (see Section 6.3.1); and the comparison of different parties' attitudes towards the drivers of (see Section 6.2.2) and barriers to (see Section 6.3.2) relational transactions. The EFA was used to identify critical factors. Before that, the *t* test has been undertaken in order to detect the significant barriers/drivers. In order to compare each party's responses, the unpaired *t* test was used.

6.2 Drivers for Adopting Relational Transaction Practices

6.2.1 Critical drivers for adopting relational transaction practices

Objective one of this study is to identify drivers for adopting relational transaction practices in public projects. In Section C of the questionnaire, respondents were asked to rate the drivers for adopting relational transactions. Table 6.1 shows that all drivers are significantly important (column 2), supporting H10 (see Section 3.10). After the first stage *t* test, the 21 drivers which are significantly important were subjected to FA (see Table 6.2).

Table 6.1: Drivers for adopting relational transactions

Code	Overall			Clients (CL)			Consultants (CS)			Contractors (CT)			CL-CS	CL-CT	CS-CT
	Rk	Mean	Sig.	Rk	Mean	Sig.	Rk	Mean	Sig.	Rk	Mean	Sig.	Sig.	Sig.	Sig.
C1	14	3.660	0.000	11	3.750	0.000	14	3.650	0.000	16	3.610	0.001	0.596	0.515	0.832
C2	3	3.850	0.000	3	4.040	0.000	6	3.730	0.000	5	3.840	0.000	0.182	0.429	0.614
C3	21	3.460	0.000	18	3.500	0.017	19	3.510	0.001	21	3.340	0.046	0.960	0.542	0.453
C4	4	3.820	0.000	3	4.040	0.000	8	3.700	0.000	8	3.790	0.000	0.094	0.218	0.669
C5	16	3.560	0.000	14	3.680	0.000	16	3.580	0.000	20	3.420	0.007	0.608	0.250	0.404
C6	2	3.950	0.000	2	4.110	0.000	4	3.830	0.000	2	3.970	0.000	0.128	0.453	0.337
C7	12	3.720	0.000	9	3.790	0.000	8	3.700	0.000	13	3.700	0.000	0.668	0.690	0.988
C8	1	4.070	0.000	1	4.180	0.000	1	3.930	0.000	1	4.150	0.000	0.173	0.894	0.186
C9	8	3.780	0.000	7	3.890	0.000	6	3.730	0.000	10	3.760	0.000	0.389	0.507	0.854
C10	18	3.550	0.000	15	3.640	0.000	20	3.500	0.000	18	3.530	0.002	0.450	0.607	0.871
C11	8	3.780	0.000	6	3.930	0.000	8	3.700	0.000	11	3.740	0.000	0.202	0.383	0.810
C12	8	3.780	0.000	3	4.040	0.000	13	3.680	0.000	14	3.690	0.000	0.070	0.092	0.947
C13	19	3.520	0.000	21	3.360	0.030	18	3.560	0.000	17	3.590	0.001	0.303	0.288	0.881
C14	4	3.820	0.000	12	3.710	0.000	1	3.930	0.000	6	3.790	0.000	0.241	0.727	0.404
C15	4	3.820	0.000	9	3.790	0.000	3	3.880	0.000	6	3.790	0.000	0.639	0.992	0.623
C16	11	3.770	0.000	8	3.860	0.000	8	3.700	0.000	6	3.790	0.000	0.447	0.735	0.636
C17	7	3.800	0.000	12	3.710	0.000	4	3.830	0.000	3	3.850	0.000	0.563	0.517	0.886
C18	15	3.590	0.000	19	3.460	0.017	16	3.580	0.001	12	3.730	0.000	0.656	0.268	0.505
C19	13	3.710	0.000	16	3.570	0.001	8	3.700	0.000	4	3.840	0.000	0.490	0.216	0.450
C20	20	3.510	0.000	20	3.390	0.005	21	3.480	0.001	15	3.670	0.000	0.680	0.140	0.321
C21	16	3.560	0.000	16	3.570	0.001	15	3.600	0.000	19	3.500	0.000	0.876	0.715	0.556

Three factors arise from the FA. All measurement items load considerably (ranging from 0.460 to 0.814) on their corresponding factors, suggesting a high convergent validity of individual measurement items within the three factors (see Table 6.2).

The *Cronbach's alpha* coefficients of these three factors range from 0.804 to 0.911; the overall reliability is 0.856. These exceed the threshold level of 0.7 (Nunnally, 1978), indicating a high degree of internal reliability of the factors.

Table 6.2: FA results of drivers

Code	**Loadings**			**Communality**	**Item-total correlation**	**Factor title**
	F1	**F2**	**F3**			
C8	.814	.077	-.238	.526	.560	Increase value proposition
C7	.688	-.107	-.127	.499	.645	
C6	.677	-.166	.026	.614	.752	
C11	.635	-.128	.208	.659	.764	
C21	.633	-.003	.117	.474	.641	
C20	.603	-.070	.009	.414	.626	
C16	.556	-.025	.229	.477	.642	
C10	.505	-.180	.325	.642	.735	
C9	.503	-.167	.211	.510	.661	
C17	.501	-.126	.176	.441	.616	
C12	.482	-.269	.076	.478	.631	
C18	.021	-.917	-.091	.818	.794	Improve business competitiveness
C19	-.002	-.812	.066	.693	.784	
C13	.091	-.791	-.036	.688	.748	
C14	.356	-.499	.126	.637	.709	
C15	.340	-.460	.131	.568	.769	
C3	.192	.058	.718	.625	.536	Improve project time and cost performance
C1	-.219	-.129	.711	.477	.627	
C4	.100	-.063	.694	.580	.669	
C2	.450	.234	.573	.600	.647	
Cronbach's alpha	.911	.903	.804			
Eigen-values	8.615	1.628	1.176			
Explained variation (%)	43.075	8.141	5.881			

Notes:

a: Extraction Method: principal axis factors; Rotation Method: direct oblique with Kaiser Normalization;

b: Rotation converged in 13 iterations;

c: Kaiser–Meyer–Olkin measure of sampling adequacy: 0.899; Bartlett's test of sphericity: Approx. chi-square: 1208.968; df: 190; Sig.:.000;

d: There are 47 (24.0%) non-redundant residuals with absolute value>0.05;

e: Missing data treatment: listwise. Little and Rubin's (1986) Missing Completely at Random (MCAR) test was performed, and the result shows that pattern of missing values does not depend on value;

f: Cumulative percentage of variation explained=57.097%; and

g: Public client's administration burden (C5) was removed due to a low loading of 0.31 on factor 1, which is less than minimum loading of 0.40 (Costello and Osborne, 2005).

Factor 1 is labeled “increase value proposition”. Public projects seeking to increase their value propositions may adopt relational transactions because they are driven by the need to improve project quality (C6) and meet public needs (C12). Projects can add value with better design (C7), better safety performance (C8), integrated solutions of efficiency improvement (C11), creative and innovative approaches (C21) and new technologies (C20).

Table 6.2 shows that the adoption of relational transactions is driven by the potential benefits of higher efficiency of resource utilization (C9) and collaborative culture (C10). This is because these measures would benefit project outcomes. Relational transaction practices involve substantial relationship exchanges and require alignment of different parties’ objectives, and these practices can benefit from efficiency in resource utilization and a collaborative culture (Akintoye and Main, 2007; Black *et al.*, 2000).

It is found that contracting parties’ relational transaction practices are motivated by the attainment of fewer disputes (C16) and better relationships (C17). Parties that are involved in more relational transactions would resolve conflicts in a non-adversarial way, giving rise to fewer disputes (C16) and better relationships (C17). Better relationships between parties can further produce project-based benefits (Black *et al.*, 2000), which would then generate greater motivation to contracting parties.

Factor 2 is labeled “improve business competitiveness”. This might confirm that competitive capabilities often rest on RC practices (Gibbons and Henderson, 2012). The desire to enhance business competitiveness drives contracting parties to adopt relational transactions. Compared to poorly connected actors, firms that are better connected to the network by having a continuity of past relationships (C19) can forge

a competitive advantage (C13) (Uzzi, 1996; Rowley *et al.*, 2000). Competitiveness can further enhance organizations' competency (C14) to improve the effectiveness of their business operations (Love *et al.*, 2002; Gittell *et al.*, 2010). This can in turn enhance organizations' reputation (C15), ultimately enabling them to seize new market opportunities (C18) (Gulati *et al.*, 2000; Starkey *et al.*, 2000).

Factor 3 is labeled "improve project time and cost performance". Firms that are driven to achieve better time (C4) and cost (C1) performance, to mitigate risks and their influences (C2), and to reduce the cost of changing partners (C3) are likely to adopt relational transactions in public projects. Good performance can provide contracting parties with market advantages based on a proven track record, thereby motivating contracting parties to adopt relational transactions (Bresnen and Marshall, 2000c).

Table 6.2 shows that the aim to achieve superior cost performance can motivate contracting parties to adopt relational transactions (C1). This may be because RC practices can result in a reduction in total project cost since partners are likely able to purchase at the lowest possible price (Beach *et al.*, 2005) and control cost more effectively (Larson, 1995; Chan *et al.*, 2008).

Table 6.2 also shows that a desire to gain better time performance (C4) can drive contracting parties to adopt relational transactions. This may be because relational transactions can enable the demand for speed (Powell, 1990) and give rise to economies of time (Uzzi, 1997). Such speed in responding can then help achieve outstanding time performance.

The need to reduce construction development risks (C2) can drive contracting parties to adopt relational transactions. This finding agrees with Akintoye and Main (2007),

who noted that the reduction of construction development risks is a crucial driver for parties to adopt collaborative activities. This may be because for construction projects which involve customization, complexities and uncertainties (Eriksson, 2008), relational transactions can be a suitable governance mechanism (Williamson, 1975). The informal agreement and unwritten codes of conducts provide a more effective mechanism to cope with risks (Brown *et al.*, 2004). Furthermore, the capability to mobilize relational transactions to benefit from risks would become a source of competitive advantage (Comet, 2009), which would significantly motivate contracting parties to adopt relational transactions.

6.2.2 Comparing different parties' perceptions of drivers

Objective two of this study is to compare different parties' perceptions of drivers for adopting relational transaction practices. The unpaired *t* test results in Table 6.1 show that the ratings of three parties are not significantly different, rejecting H12 (see Section 3.10). It also shows that all drivers are significantly important for individual groups (*i.e.*, CL, CS and CT).

The results show that all three parties are significantly driven to adopt relational transactions because of the aim to achieve better project safety (C8) and quality performance (C6). Three parties' top emphasis in safety is to ensure compliance with laws and regulations and to pass inspections conducted by the Building Construction Authority (BCA) and the Ministry of Manpower. Public clients also have a strong impetus to ensure that their projects achieve high standards of safety because public projects are highly visible and the government must be seen to care for the lives of people working on the construction projects.

The results show that parties are also significantly driven to adopt relational

transaction practices because of the need to improve project quality (C6). This is because taxpayers' money is involved and the contracting parties are obligated to deliver satisfactory products to end users. Delivering a high standard of quality in public projects would also help to enhance public confidence and support. Private parties also wish to build a sound track record of quality and safety performance as it accounts for at least 20% (for contractors) and 60% (for consultants) of the overall score of bid evaluation in public projects (BCA, 2012).

6.3 Barriers to Adopting Relational Transaction Practices

6.3.1 Critical barriers to adopting relational transaction practices

Objective one of this study is also to identify barriers to adopting relational transaction practices in public projects. In Section D of the questionnaire, respondents were requested to rate the factors deterring relational transactions. The *t* test results show that 15 of the 23 barriers significantly impede the adoption of relational transactions (see Table 6.3). Therefore, H11 is not rejected (see Section 3.10). This result departs from those of previous studies that did not differentiate between public and private projects. For example, Kumaraswamy *et al.*'s (2005) study found that for projects in general, bureaucratic client organization (D21), stringent public client sector rules and regulations (D22), and public sector accountability concerns (D20) do not significantly deter the adoption of RC practices and building of integrated teams. In this study that focuses on public projects, these variables now become significant barriers.

After deleting 8 non-significant barriers, the remaining 15 barriers were subjected to FA (see Table 6.4). The result of the KMO test is 0.803, and Bartlett's test is significant at the 0.000 level. These results indicate the factorability of the data matrices (Hair *et al.,* 1998).

All of the measurement items load considerably (ranging from 0.511 to 0.907) on their corresponding factors, indicating a high convergent validity of individual measurement items within each factor. Four factors emerge from the FA (see Table 6.4). These four factors explain 63.71% of the variance. Three of the four factors have *Cronbach's alpha* coefficients below 0.7 (*i.e.*, Factors 2, 3 and 4). However, in the field of construction research, Leung and Chan's (2007) study accepted factors with *Cronbach's alpha* coefficients of 0.5. In this research, the *Cronbach's alpha* coefficients are above 0.5 and they also have a high level of reliability with a high item-total correlation (>0.3) (Nunnally, 1978).

Factor 1 is labeled "lack of capabilities". The lack of capabilities diminishes the possibility of adopting relational transactions. For example, a lack of experience (D5) and training (D2) in relational arrangements may impede the adoption of relational transactions. This result agrees with Ng *et al.* (2002) who noted that a lack of experience in RC practices may lead to a failure to implement appropriate training and guidance measures. When contracting parties have little or no experience in RC practices, they may fear the unknown (Glagola and Sheedy, 2002) and have misgivings that long term relationships are too 'cosy' and uncompetitive (Bresnen and Marshall, 2000a). These uncertainties may prevent parties from reaping the potential benefits of adopting RC and fully committing to RC practices.

Table 6.3: Barriers to adoption of relational transactions practices

Code	Overall			Clients (CL)			Consultants (CS)			Contractors (CT)			CL-CS	CL-CT	CS-CT
	Rk	Mean	Sig.	Rk	Mean	Sig.	Rk	Mean	Sig.	Rk	Mean	Sig.	Sig.	Sig.	Sig.
D1	18	3.150	0.099	12	3.360	**0.030**	14	3.150	0.262	20	2.930	0.678	0.330	0.069	0.298
D2	11	3.250	**0.003**	12	3.360	**0.022**	8	3.260	0.067	11	3.110	0.477	0.622	0.237	0.467
D3	19	3.140	0.169	12	3.360	0.077	19	3.080	0.608	13	3.070	0.663	0.248	0.276	0.990
D4	20	3.110	0.167	19	3.210	0.161	16	3.130	0.324	19	3.000	1.000	0.663	0.335	0.533
D5	14	3.220	**0.019**	12	3.360	**0.039**	12	3.180	0.213	13	3.070	0.678	0.417	0.245	0.641
D6	21	3.080	0.374	21	3.140	0.404	21	3.030	0.872	18	3.040	0.813	0.619	0.636	0.965
D7	17	3.180	0.088	9	3.390	**0.039**	17	3.100	0.562	13	3.070	0.691	0.264	0.210	0.904
D8	7	3.310	**0.000**	7	3.480	**0.013**	12	3.180	0.090	5	3.300	**0.043**	0.162	0.420	0.516
D9	8	3.280	**0.004**	9	3.390	**0.039**	7	3.310	**0.044**	13	3.070	0.663	0.715	0.191	0.291
D10	13	3.230	**0.029**	7	3.480	**0.030**	17	3.100	0.512	10	3.140	0.460	0.142	0.236	0.869
D11	16	3.180	0.075	19	3.210	0.326	19	3.080	0.571	3	3.370	**0.039**	0.581	0.572	0.185
D12	10	3.260	**0.002**	5	3.570	**0.002**	8	3.260	**0.031**	21	2.890	0.376	0.111	**0.002**	**0.036**
D13	15	3.210	**0.023**	17	3.250	0.199	10	3.240	0.060	13	3.070	0.678	0.952	0.501	0.435
D14	22	2.940	0.434	22	3.070	0.678	23	2.950	0.644	22	2.850	0.294	0.530	0.323	0.592
D15	6	3.330	**0.000**	17	3.250	0.109	6	3.490	**0.001**	8	3.180	0.259	0.243	0.742	0.134
D16	5	3.380	**0.000**	16	3.290	0.118	4	3.590	**0.000**	11	3.110	0.477	0.154	0.443	**0.016**
D17	8	3.280	**0.009**	9	3.390	**0.025**	11	3.230	0.202	6	3.250	0.244	0.523	0.595	0.944
D18	12	3.240	**0.012**	6	3.500	**0.011**	14	3.150	0.295	8	3.180	0.232	0.137	0.174	0.907
D19	23	2.820	0.049	23	2.570	0.050	22	3.000	1.000	22	2.850	0.294	0.083	0.268	0.429
D20	1	3.710	**0.000**	2	4.000	**0.000**	1	3.850	**0.000**	7	3.230	0.136	0.426	**0.001**	**0.003**
D21	2	3.640	**0.000**	3	3.750	**0.000**	2	3.670	**0.000**	1	3.430	**0.026**	0.702	0.189	0.302
D22	3	3.610	**0.000**	1	4.040	**0.000**	5	3.510	**0.005**	4	3.320	0.107	**0.044**	**0.009**	0.465
D23	4	3.600	**0.000**	4	3.710	**0.011**	3	3.620	**0.001**	2	3.410	0.062	0.742	0.365	0.442

Table 6.4: FA results of barriers

Code	Loadings				CM	Item-total correlation	Factor title
	F1	F2	F3	F4			
D2	.785	.060	.066	-.055	.636	.720	Lack of capabilities
D5	.774	.073	.105	-.066	.556	.667	
D18	.730	.005	-.204	.085	.556	.583	
D17	.729	-.044	.102	-.014	.557	.628	
D9	.714	.052	-.064	.109	.578	.637	
D10	.525	-.463	.122	.462	.740	.545	
D12	.511	.409	.216	-.126	.583	.509	
D23	.112	.755	-.085	.144	.665	.541	Ethos of public service
D16	.128	.654	.305	-.047	.648	.489	
D20	-.047	.596	-.034	.396	.573	.445	
D15	-.107	-.044	.907	.024	.780	.462	Lack of continuity
D13	.247	.079	.680	.151	.712	.462	
D22	-.178	.140	.197	.853	.773	.490	Institutional constraints
D21	.411	-.050	-.010	.568	.645	.494	
D8	.176	.191	-.077	.540	.468	.428	
Cronbach's alpha	.850	.665	.630	.654			
Eigen-values	5.470	1.728	1.281	1.077			
Explained variation (%)	36.468	11.518	8.542	7.180			

Note:

a: Extraction Method: Principal component analysis; Rotation Method: direct oblique with Kaiser Normalization;
b: CM: communality
c: Rotation converged in 12 iterations;
d: Missing data treatment: Replacement with mean value; Little and Rubin's (1986) Missing Completely at Random (MCAR) test was performed, and the result shows that pattern of missing values does not depend on value;
e: Kaiser–Meyer–Olkin measure of sampling adequacy: 0.803; Bartlett's test of sphericity: Approx. chi-square: 538.301; df: 105; Sig:.000;
f: there are 65 (61.0%) non-redundant residuals with absolute value>0.05; and
g: Cumulative percentage of variation explained=63.708%.

Table 6.4 also shows that the lack of empowerment in public clients' representatives (D17) and the lack of clients' initiative in RC practices (D9) can impede the adoption of relational transactions. A lack of empowerment on the part of the client's representatives inhibits the efficiency of the problem resolution process (Ng *et a*l., 2002). This inefficiency in the problem solving process may further hamper contracting parties' commitment to relational transactions. Other studies have also found that clients' unwillingness to fully commit to RC practices also impedes the adoption of RC practices (*e.g.*, Hayford and Utz, 2002; Ng *et al.*, 2002). Their unwillingness puts RC development at a low priority, thus forcing the contract on the traditional adversarial route.

It is found that fear of partners' opportunistic behaviors (D12) and mistrust (D18) can hinder the adoption of relational transactions. This may be due to the heavy reliance on formal contracts which are too rigid and which do not emphasize collaboration and sharing of responsibilities and risks (Eriksson *et al.*, 2008). This may consequently lead to a higher level of mistrust and higher transaction costs incurred by monitoring each party closely.

Factor 2 is labeled "ethos of public service". Public projects face more constraints from public accountability (D20) and public clients cannot be seen to have a 'hand-in-glove' relationship with private parties (D23). These findings agree with Ross (2003), who stated that audit issues should be managed carefully in public projects. By contrast, boundary permeability along with minimal internal regulations in private projects gives rise to higher possibilities of implementing relational transactions (Rahman and Kumaraswamy, 2004b).

A conservative culture (D16) is quite prevalent in the construction sector. As Palaneeswaran and Kumaraswamy (2000:285) have noted, government officials may have the attitude where 'there is no need to change current approaches/practices that are good enough (or even better than others)', or may manifest the 'not invented here' syndrome.

Factor 3 is labeled "lack of continuity". Parties who tend to adopt relational transactions need to spend more efforts understanding the soft principles (D15) and establishing a compatible culture (D13). Personnel also need to spend time nurturing close working relationships with each other. A significant amount of time is also required to find the right partners, build the team, and establish and implement procedures and rules (Cook and Hancher, 1990). Without these efforts, an integrative

and collaborative culture is difficult to be cultivated. If the culture is incompatible (D13), contracting parties may work against each other, pursuing their own objectives which may be inconsistent with the overall project outcomes.

Factor 4 is labeled "institutional constraints." Parties in public projects are expected to strictly adhere to rules, regulations and laws (D22). Due to these pre-set regulations, public clients are likely to face more constraints in their internal operations and contractual relationships (*e.g.*, Crowley and Karim, 1995; Chan *et al.*, 2001). In addition, strong commitment to fairness and transparency in public procurement may preclude the adoption of alternative relationship-based approaches (D8) (Jones, 2002).

In public projects, large bureaucratic organizations (D21) are likely to face more difficulties when adopting relational practices. This finding agrees with Ng *et al.* (2002) who found that the large amount of administrative requirements and the less flexible approach associated with large organizations are likely to decrease the efficiency of open communication among contracting parties. This then undermines parties' faith in their clients' ability to implement relational transactions.

6.3.2 Comparing different parties' perceptions of barriers

Objective two of this study is also to compare different parties' perception of barriers to adopting relational transaction practices. Table 6.3 shows that 14, eight and three of the 23 factors are significant barriers faced by public clients, private consultants and contractors respectively. Unpaired *t* test results show several instances (*i.e.*, D12, D16, D20 and D22) where the rating of one party is significantly different from other parties. Therefore, H13 is not rejected (see Section 3.10).

Among the 23 possible barriers, five (*i.e*., D3, D4, D6, D14 and D19) are not significantly barriers faced by any party. On the other hand, only one barrier namely bureaucratic public client organizations (D21) significantly deter all three parties from adopting relational transactions. This finding confirms presence of a large amount of administrative requirements and less flexible approaches in public projects. The differences in barriers faced by each group of respondents are discussed in the next sections.

6.3.2.1 Barriers faced by public clients only

The results show that seven barriers are significantly encountered by public clients only. The results show that, from public clients' stance, contracting parties hesitate to adopt relational transactions because of the lack of background in the form of lack of knowledge of relational approaches (D1), training and guidance in relational arrangement (D2) and experience in relational arrangements (D5) (see Table 6.3). Public clients expressed this significant concern because the absence of such background may lead to a lack of confidence among team members (Ling *et al.*, 2006). It would furthermore cause parties not to commit fully to relational transactions. To strengthen such background, contracting parties can draw more relational transaction related lessons from successful cases; attend RC workshops and training courses.

Table 6.3 shows that the lack of top management support (D7) is a significant barrier for public clients. This agrees with previous findings that a lack of top management support impedes the adoption of relational transaction practices (*e.g.*, Akintoye *et al.*, 2000; Eriksson *et al*., 2008). As top management's commitment wanes, the commitment to RC practices at the project level follows suit (Akintoye *et al.*, 2000). Consequently, it would deter individual decision makers from trying new approaches regardless of the potential advantages (Eriksson *et al.*, 2008).

Besides a lack of top management support from each party, the lack of empowerment in client's representatives (D17) is significant barrier for public clients. A lack of empowerment on part of the client's representatives would inhibit efficiency of the problem resolution process (Ng *et a*l., 2002). This inefficiency in problem solving process might further hamper contracting parties' commitment to relational transactions.

The results in Table 6.3 show that public clients are the only party that regarded the lack of common goals among contracting parties as a significant barrier (D10). This confirms Cook and Hancher's (1990) finding that clients and contractors have the substantially different goals and each party has self-interest (Drexler and Larson, 2000; Packham *et al.*, 2003). Without common goals, contracting parties would pursue their own objectives regardless of the overall project performance which might lead to conflicts. As a result of more conflicts, relationships would worsen. It is suggested that communication of objectives and expectations during the formative phase might be helpful for parties to adopt common goals (Rahman and Kumaraswamy, 2004a; Love *et al.*, 2010).

It is also found that public clients are the only party that rated the lack of trust among contracting parties (D18) as a significant barrier. The trust issue is only faced by clients because they need to rely on contractors and consultants to supply their services to a high level of quality at the agreed price. For consultants and contractors, trust is not a problem because the public sector can be relied on to make payment promptly. Clients might be also aware that their price-dominated selection criterion entices tenderers to lower their bids to win contracts, relying on subsequent claims to recover their costs (Rahman and Kumaraswamy, 2004b). This would make their relationships adversarial at the start of the project and trust difficult to develop. It is

suggested that a key person in each party be identified to work closely with the others as the development and maintenance of trust are largely at the inter-personal level.

6.3.2.2 Barriers faced by contractors only

Contractors are the only party who considered interpersonal clash as a significant barrier (D11). Being lower than clients and consultants on the value chain, contactors are not in any position to ask for clients' representative or consultants to be replaced if they have interpersonal clashes with contractors. Interpersonal barriers, originating from individual people's working attitude or previous contractual relationships, are the hardest to overcome (Glagola and Sheedy, 2002). To avoid interpersonal clashes, it is suggested contractors appoint amiable site management staff who possess superior soft skills, like effective negotiation and communication.

6.3.2.3 Barriers faced by consultants only

The results in Table 6.3 show that consultants are the only ones who felt that D15 and D16 are significant barriers to relational transactions. Consultants felt time required to develop relationships (D15) is a significant barrier. This might be because consultants would much prefer to get on with the project rather than to spend a significant amount of time to find right partners and build the team (Cook and Hancher, 1990).

The results in Table 6.3 show that consultants are the only party who rated "conservative industry culture inhibits changes and encourages preservation of the status quo" (D16) as a significant barrier. In addition, their rating is significantly higher than contractors. This may be because consultants' behaviors are significantly influenced by the stance adopted by public clients. For public clients, traditional contracting is often perceived as less risky (Kadefors, 2004), which discourages them from relational transactions. Another reason may be that private consultants still lack

experience in relational transactions. For example, they may not know how to handle a situation where they need to waive legal rights (Ross, 2003). This would lead them to fall back on the formal contractual governance.

It is acknowledged that transforming such a conservative culture within a short period would be extremely challenging. Nevertheless, it is suggested that contracting parties attach more importance to the early post-contractual phase. For example, upon signing a contract, contracting parties could adopt joint learning processes and use interpretive flexibility to signal trust and commitment (Dewulf and Kadefors, 2012). It is also suggested that public clients take the initiative in relational transactions, which would in turn influence consultants' regards for relational transactions.

6.3.2.4 Barriers faced by two parties

The results in Table 6.3 show that six barriers (*i.e.*, D8, D9, D12, D20, D22 and D23) were significantly accorded by two parties. Both public clients and contractors felt that "lack of acceptance of relational approaches as a long-term way of doing business (D8) is a significant barrier to relational transactions. The lack of acceptance from the public sector might be because public clients show greater reluctance to adopt changes (Palaneeswaran and Kumaraswamy, 2000) and they prefer to select the traditional routines even if they agree with the RC in principle (Clifton *et al.*, 2004; Lædre *et al.*, 2006). On the other hand, the reason contractors did not accept relational transactions as a long term way of doing business (D8) might be their awareness that public clients need to have transparency. Due to the wide use of open tendering, a well-performing contractor may not improve its chances of winning the next contract, even with the same public client (Weston and Gibson, 1993). Without expectations of future business opportunities, contractors would be less motivated to adopt relational transactions in a long run. Consultants did not see D8 as a significant barrier because selection of consultants to undertake public projects are less

dependent on submitting the lowest price, but more on consultants' experience and track record.

The results show that both public clients and private consultants considered the lack of client's initiative in relational practices as a significant barrier (D9). This might be because, compared to private parties' practices, the public sector has rigid and impermeable organizational boundaries within government agencies (Crowley and Karim, 1995; Chan *et al.*, 2001; Rahman and Kumaraswamy, 2004b). The pre-existing systems would force them to focus on the formal controls, which might deter public clients from initiating relational transactions.

The results indicate that both public clients and consultants rated concerns about opportunistic behaviors of other contracting parties (D12) to be a significant barrier. Their ratings are significantly higher than contractors. Opportunism arises due to bounded rationality-that the formal contract could not completely spell out what is to be done in all situations. Yet, both public clients and consultants still prefer the formal controlling tools. For example, one respondent from the public sector indicated that: *"relational transactions must be done within the contract and laws". "Clients need to select a contractor with devotion and passion to execute the works as per contractual provision".* As a result of the incompleteness of formal contracts, the preference for formal controlling tools would inevitably lead to opportunism. In addition, in the traditional design-bid-build arrangement, the "us-and-them" syndrome causes clients and consultants to be wary of contractors trying to outfox them.

The results in Table 6.3 show that public clients and private consultants face a significant barrier to implement relational transactions because of concerns about public accountability (D20). Their ratings are significantly higher than contractors. Public clients and consultants have converging perceptions because consultants

represent clients and are responsible for ensuring rules and procedures are complied with. Public clients are obligated to fulfill the fundamental delivery principles and meet public service ethos; thus they would eschew activities involving close relationships. A respondent from the public sector indicated that "*relational transactions are difficult to implement in the public sector due to sensitivity in work functions and possible allegations of corruption*".

Table 6.3 shows that public clients and private consultants face a significant barrier of stringent rules, regulations and laws (D22). The rating of public clients is significantly higher than private consultants and contractors. This confirms that the Singapore government's strong commitment to transparency and accountability through various policies in public sector procurement would preclude the adoption of collaborative approaches (Jones, 2002). Since all matters in public projects are open to internal and external audits, public clients would accord a higher priority to the formal controlling approaches rather than relational transactions. The findings indicate that the adoption of relational transactions should be subjected to compliance with the stipulated rules and regulations.

The results show that both public clients and consultants rated that the need to avoid possible allegations of corruption arising from close relationships between client and other contracting parties (D23) significantly impedes the adoption of relational transactions. Allegations may arise if decisions are made in an unfair and unethical manner (Glagola and Sheedy, 2002). However, this is not to say that contracting parties cannot build good working relationships. One respondent from the public sector commented that: "*It is very often that the success of a mega-infrastructure public project is achieved because trustworthy and good working relationships were developed*".

6.4 Summary

The *t* test results show that the adoption of relational transactions in public projects is significantly motivated by the 21 drivers but deterred by the 15 barriers (see Tables 6.1 and 6.3). Three factors were detected from the 21 drivers: (i) increasing value proposition; (ii) improving business competitiveness; and (iii) improving project time and cost performance (see Table 6.2). The 15 significant barriers were reduced into four factors: (i) lack of capabilities; (ii) ethos of public service; (iii) lack of continuity; and (iv) institutional constraints (see Table 6.4).

The comparison results show that 21 drivers significantly motivate three parties to adopt relational transactions; three parties' perceptions of the drivers are not significant different (Table 6.1). It shows that 14, eight and three of the 23 barriers significantly deter public clients, consultants and contractors from relational transactions respectively. Unpaired *t* test for barriers shows that parties' perceptions are not significantly different except for D12, D16, D20 and D22 (Table 6.3).

Chapter 7 Relational Transaction Practices and Project Outcomes

7.1 Introduction

Objectives three and four of this study are to examine whether relationship quality could give rise to better project outcomes and to explore to what extent relational transaction practices could lead to better outcomes and relationship quality (see Section 1.3). This chapter aims to identify relational transaction practices that lead to better relationships and project outcomes and to examine whether relationship quality can contribute to project outcomes (see Section 7.5). PLS-SEM was adopted, which comprises two stages: model specification (see Section 7.2) and model evaluation (see Section 7.4). Before that, the *t* test on relational transactions practices was conducted (see Sections 7.3). After obtaining statistical results, experts' views were used to validate the framework (see Section 7.6). In the end, how to apply the empirically tested model in construction is presented (see Section 7.7).

7.2 Model Specification for PLS-SEM

This section specifies the measurement models (see Sections 7.2.1 and 7.2.2) and the structural model (see Section 7.2.3). Lohmoller (1982) presented examples where a model with 96 indicators, and 26 constructs was estimated with 100 data cases. In this study, there are 12 constructs and 104 samples, which is enough for performing PLS-SEM.

7.2.1 Measurement model specification for independent constructs

The measurement items and constructs (see Table 7.1) were specified using reflective-formative hierarchical models (see Table 4.2). The first and second order constructs are reflective and formative respectively. For example, the second-order

construct "information sharing (IS)" is manifested by three first-order constructs which is the information sharing between each two parties (*i.e.*, IS_CL&CS, IS_CL&CT and IS_CT&CS) (see Figure 7.1). The reason to use formative mode for the second-order constructs is that each dyad's communication is not assumed to correlate with others. However, removing any pair would violate the validity of the second-order construct. These fit the characteristics of formative modes (see Section 4.6.4.2). In addition, the measurement items used to measure the first order constructs are reflective, as there is conceptual correlation among the measurements and removing any of them may not seriously violate the construct validity.

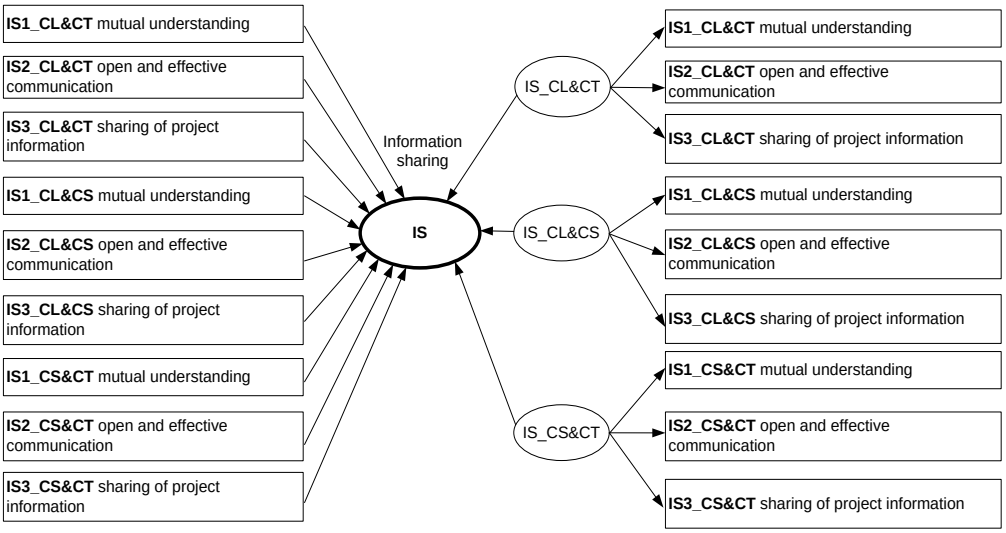


Figure 7.1: An example of hierarchical construct model of information sharing (IS)

The next reason to adopt reflective-formative hierarchical models is that when multiple first order constructs are able to fully capture the entire domain of the second order construct, making a formative relationship between second order and first order constructs suitable (Petter *et al.*, 2007). The final reason is that each first order construct represents some portion of the second construct, making reflective-formative hierarchical model relevant (Law and Wong 1999:144). This method of specifying the independent constructs was also adopted by other researchers (see Ring *et al.*, 2012).

Based on the reflective-formative methods for hierarchical model specification, eight independent constructs were input in to the PLS-SEM model (see Table 7.2). These are trust (TR), joint problem solving (PS), information sharing (IS), flexibility (FL), contractual solidarity (SO), harmonization within the social matrix (HM), role integrity (RI) and propriety of means (PR). The former three constructs are underpinned by the theory of Network Embeddedness and the latter five are supported by the theory of Relational Contracts (see Figure 3.1 in Section 3.2).

7.2.2 Measurement model specification for dependent constructs

The dependent constructs comprise cost performance (Y_1), time performance (Y_2), satisfaction (Y_{31} and Y_{32}) and relationship quality (Z_1 to Z_3). These dependent variables were subject to factor analysis (see Table 7.1). Given a lack of strong theories about the number and nature of the underlying outcome indicators and relationship quality (*i.e.*, Y and Z), EFA was performed.

Three components were initially derived from seven indicators. Component 1 and 2 are labeled as relationship quality and satisfaction respectively. Considering the low *Cronbach's alpha* value of component 3 (less than 0.7) (Nunnally, 1978), a decision was made to keep Y_1 and Y_2 separate. This decision was based on the suggestion by Bergkvist and Rossiter (2007; 2009) that using single-item measurement is sensible if the scope of the construct is narrow, uni-dimensional and unambiguous. In the end, four components were attained: cost performance (Y_1); time performance (Y_2); satisfaction (Y_3); and relationship quality (Z).

Table 7.1: Factor analysis of outcome indicators

Code	**Measurement items**	**Component**			**CM**
		1	**2**	**3**	
Z1	Relationship between CL&CS at the end	.839	-.002	.097	.828

Code	Measurement items	Component			CM
		1	2	3	
Z2	Relationship between CS&CT at the end	.801	.090	-.039	.760
Z3	Relationship between CL&CT at the end	.718	.294	.218	.649
Y31	Product/output quality	.007	.909	.045	.652
Y32	Client Satisfaction	.259	.812	.181	.713
Y1	Cost	-.094	.131	.855	.757
Y2	Time	.321	.073	.754	.678
Cronbach's alpha		.803	.718	.529	
Eigen-values		2.643	1.323	1.069	
Percentage of variation explained (%)		37.76	18.902	15.277	

Note:

a. Extraction Method: principal component analysis; Rotation Method : direct oblique with Kaiser Normalization
b. Rotation converged in 4 iterations;
c. CM: communality
d. Kaiser–Meyer–Olkin measure of sampling adequacy: 0.661; Bartlett's test of sphericity: Approx. chi-square: 106.082; df: 21; Sig.:.000;
e. Missing data: listwise; and
f. Cumulative percentage of variation explained (71.941%).

7.2.3 Structural model specification

Figure 7.2 shows that the structural model regarding the relationships among relational transactions (X) (see Section 3.3), relationship quality (Z) (see Section 3.5) and project outcome (Y) (see Section 3.4). The hypothesized relationships are described in Section 3.10.

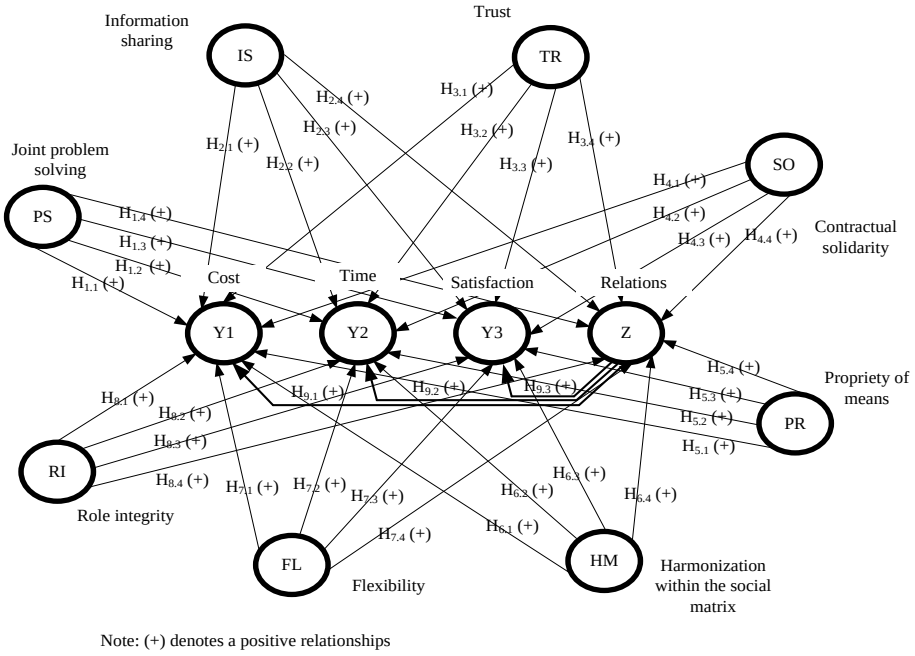


Figure 7.2: Proposed structural model for boosting outcomes through relational transactions

Table 7.2: Measurement models for relational transaction practices and outcomes

Second order constructs	First order	Code	Measurement items
Trust (TR)	CL CT CS	TR1	Mutual trust among each other
		TR2	Level of interpersonal relations/cultural harmony (individual level)
Problem solving (PS)		PS1	Adjustable contracts to address uncertainties
		PS2	Commitment level of contracting parties to joint problem solving
		PS3	Presence of conducive learning climate/environment
		PS4	Acceptance of dispute resolution mechanism for the project
Information sharing (IS)	CL CS CT	IS1	Mutual understanding among each other
		IS2	Open and effective communication among each other
		IS3	Sharing of project information among each other
Flexibility (FL)	CL CS CT	FL1	Flexibility when situations change
		FL2	Readiness to compromise on unclear issues
Contractual solidarity (SO)		SO1	Acceptance of agreed performance appraisal mechanism for the project
		SO2	Alignment of objectives of different contracting parties
		SO3	Collective/combined responsibilities by a pre-selected group comprising one person from each major party
		SO4	Joint coordination and monitoring plans among contracting parties
Harmonization within the social matrix (HM)	CL CS CT	HM1	Previous relationships among each other
		HM2	Ongoing social relationships among each other
Role integrity (RI)	CS CL CT	RI1	Commitment of resources to the project
		RI2	Long-term commitment
		RI3	Spirit of teamwork
		RI4	Continuous improvement
Propriety of means (PR)	Formality (FM)	FM1	Clarity of division of responsibilities among contracting parties
		FM2	Clarity of the terms and conditions in contract
	Fairness (FA)	FA1	Clearly defined equitable risk-sharing arrangement among contracting parties
		FA2	Real gain-share/pain-share among contracting parties
Cost (Y1)		Y1	Cost performance
Time (Y2)		Y2	Time performance

Second order constructs	First order	Code	Measurement items
Satisfaction (Y3)		Y31	Project quality
		Y32	Client's satisfaction
Relationship quality (Z)		Z1	Relationships between clients and contractors at the end of the project
		Z2	Relationships between consultants and contractors at the end of the project
		Z3	Relationships between clients and consultants at the end of the project

Note: CL denotes client, CS denotes consultant, CT denotes contractor; the letters in the bracket denote corresponding abbreviation in the modeling.

7.3 Descriptive Analysis of Relational Transaction Practices

7.3.1 Significant relational transaction practices

In Section B of the questionnaire, the extent to which relational transaction practices are adopted in public projects was investigated. The *t* test results in Table 7.3 show that 46 out of the 51 relational transaction practices are implemented to a significant extent (T-value>0; p<0.05).

The results show that five practices are not implemented to a significant extent, which relate to ongoing social relationships among contracting parties (*i.e.*, HM2_CT&CS, HM2_CL&CS and HM2_CL&CT), pre-existing familiarity between contractors and consultants (HM1_CT&CS) and real gain-share/pain-share arrangement (FA2).

The results in Table 7.3 indicate that the extent to which contracting parties have ongoing social relationships (*i.e.*, HM_2CT&CS, HM_2CL&CS and HM2_CL&CT) is not significant. This might be because the strict regulations precluded high level of social networks among participants. For example, in the public procurement, *"where officers administer the allocation of government contracts in which they or their close relatives have any interest at all, or where they hold dual appointments in the company interested in the contract, they should declare these interests and disqualify themselves from handling the matter altogether" (GeBIZ, 2011).*

The results in Table 7.3 also show that public projects exhibit a non-significant level of previous familiarity between contractors and consultants (HM_1CT&CS). This is mainly because of competitive tenders used to procure both consultancy and construction services, which would significantly reduce the possibility to assemble a team where consultants and contractors have previous relationships.

The results also indicate that public projects do not adopt real gain-share/pain-share arrangement to a significant extent (FA2). This might be because the contract is usually designed by public clients which tend to protect the interests of the public sector.

Table 7.3: *t* test of relational transaction practices

Code	Mean	T-value	Sig.
IS1_CL&CT	3.42	5.061	0.000
IS2_CL&CT	3.64	7.571	0.000
IS3_CL&CT	3.67	7.849	0.000
IS1_CL&CS	3.71	9.091	0.000
IS2_CL&CS	3.72	8.571	0.000
IS3_CL&CS	3.79	9.988	0.000
IS1_CT&CS	3.47	5.432	0.000
IS2_CT&CS	3.67	9.456	0.000
IS3_CT&CS	3.76	10.613	0.000
TR1_CL&CT	3.36	3.677	0.000
TR2_CL&CT	3.55	6.141	0.000
TR1_CL&CS	3.64	7.979	0.000
TR2_CL&CS	3.62	8.111	0.000
TR1_CT&CS	3.37	3.845	0.000
TR2_CT&CS	3.48	5.661	0.000
PS1	3.23	2.697	0.008
PS2	3.79	9.726	0.000
PS3	3.37	4.296	0.000
PS4	3.55	7.517	0.000
FL1_CL	3.43	4.361	0.000
FL2_CL	3.35	3.525	0.001
FL1_CT	3.77	9.876	0.000
FL2_CT	3.53	6.04	0.000
FL1_CS	3.56	5.966	0.000
FL2_CS	3.39	4.759	0.000
RI1_CT	3.98	12.129	0.000
RI_CT2	3.84	8.555	0.000
RI_CT3	3.97	12.11	0.000
RI_CT4	3.8	9.985	0.000
RI_CL1	3.81	8.337	0.000
RI_CL2	4.04	9.664	0.000
RI_CL3	3.97	11.31	0.000
RI_CL4	3.96	11.28	0.000
RI_CS1	3.41	4.206	0.000
RI_CS2	3.78	8.426	0.000
RI_CS3	3.77	8.502	0.000

Code	Mean	T-value	Sig.
RI_CS4	3.75	10.7	0.000
HM1_CL&CT	3.33	2.715	0.008
HM2_CL&CT	3.02	**0.188**	**0.851**
HM1_CL&CS	3.55	5.475	0.000
HM2_CL&CS	3.13	**1.365**	**0.176**
HM1_CT&CS	3.14	**1.34**	**0.183**
HM2_CT&CS	2.99	**-0.111**	**0.912**
FM1	3.93	14.317	0.000
FM2	3.83	9.777	0.000
FA1	3.38	4.509	0.000
FA2	3.16	**1.833**	**0.070**
SO1	3.73	11.828	0.000
SO2	3.6	7.793	0.000
SO3	3.45	5.851	0.000
SO4	3.65	8.006	0.000

Note: see Table 7.2 for detailed description of relational transaction practices

7.3.2 Comparing different parties' relational transaction practices

The next step is to investigate if there is significant difference in the extent to which individual contracting parties adopt relational transaction practices. The unpaired *t* test results in Table 7.4 show that both public clients and contractors commit significantly more resources (RI1) to the project than consultants. It seems reasonable because consultancy services essentially involve less physical resources.

Table 7.4: Unpaired *t* test of individual practices

Code	CL	CT	CS	CL-CT		CL-CS		CT-CS	
	Mean	Mean	Mean	t-value	Sig.	t-value	Sig.	t-value	Sig.
FL1	3.43	3.77	3.56	**-2.70**	**0.01**	-0.94	0.35	1.73	0.09
FL2	3.35	3.53	3.39	-1.39	0.17	-0.32	0.75	1.18	0.24
RI1	3.81	3.98	3.41	-1.33	0.19	**2.89**	**0.00**	**4.48**	**0.00**
RI2	4.04	3.84	3.78	1.39	0.17	1.84	0.07	0.43	0.66
RI3	3.97	3.97	3.81	-0.01	1.00	1.31	0.19	1.36	0.17
RI4	3.96	3.80	3.75	1.38	0.17	1.87	0.06	0.43	0.67

The results in Table 7.4 also show that in contrast to contractors, public clients are seen to be significantly less flexible when situation changes (FL1). Public clients usually have less room for flexibility because of bureaucracy (Ross, 2003). Their

works are also subject to audits by both internal organizations and external government agencies. Any decision made by the public officer needs to be sufficiently supported by evidence and reasonable justifications.

Table 7.5 shows that clients and consultants are more likely to trust (TR1) and understand (IS1) each other. This might be because consultants are the representatives of the public clients and they are supposed to stand with each other.

Table 7.5: Unpaired *t* test of mutual practices

Code	**CL& CT**	**CL& CS**	**CT& CS**	**CL&CT-CL&CS**		**CL&CT-CT&CS**		**CL&CS-CT&CS**	
	Mean	Mean	Mean	t-value	Sig.	t-value	Sig.	t-value	Sig.
HM1	3.33	3.55	3.14	-1.44	0.15	1.14	0.25	**2.79**	**0.01**
HM2	3.02	3.13	2.99	-0.75	0.45	0.21	0.83	1.05	0.30
TR1	3.36	3.64	3.37	**-2.17**	**0.03**	-0.03	0.98	**2.19**	**0.03**
TR2	3.55	3.62	3.48	-0.64	0.52	0.49	0.62	1.19	0.24
IS1	3.42	3.71	3.43	**-2.46**	**0.01**	-0.07	0.94	**2.25**	**0.03**
IS2	3.64	3.72	3.67	-0.69	0.49	-0.29	0.78	0.46	0.64
IS3	3.67	3.79	3.76	-1.06	0.29	-0.80	0.43	0.32	0.75

The comparison results in Table 7.5 show that consultants have significantly higher familiarity with public clients as compared to contractors (HM1). This might be because consultancy services are procured from the PSPC list with a limited number of entities and some public clients even have in-house consultancy services (see Table 5.6). Therefore, it gives rise to a higher possibility to continue previous relationships. On the contrary, contractors are generally procured through open bidding (see Table 5.5), thereby giving a lower likelihood of familiarity between contractors and consultants.

7.4 Model Evaluation Results

The proposed measurement models and structural model was input to the software SmartPLS (Ringle *et al.*, 2005). The model evaluation comprises assessment of measurement models (see Section 7.4.1), hierarchical models (see Section 7.4.2) and

structural model result (see Section 7.4.3).

7.4.1 Evaluating measurement models

Table 7.6 presents the measurement model evaluation result. It shows that: (i) all loadings are greater than 0.4 with t-values greater than 2.58, indicating an acceptable indicator reliability (Churchill, 1979); (ii) the values of composite reliability (CR) are over 0.7, suggesting a satisfactory level of reliability of internal indicators within each construct (Bagozzi and Yi 1988); (iii) the values of AVE are more than 0.5, showing a satisfactory level of convergent validity of the constructs (Fornell and Larcker, 1981). The weights in Table 7.6 are used to estimate the score of constructs through the measurement items.

In addition, each latent construct's AVE is higher than its squared correlation with any other construct and each measurement is loaded the highest on the corresponding construct (see Appendix 4). These are an indication of discriminate validity of the constructs (Cenfetelli and Bassellier 2009; Hair *et al.*, 2011; 2012).

Based on the results above, it can be concluded that the measurement models are valid in terms of measuring the first order constructs through the measurement items. The next step is to evaluate hierarchical models, aiming to examine the validity of measuring the second order constructs using the first order constructs.

Table 7.6: Overview of measurement model evaluation

Direction	**Loading**	**Weight**	**T-value**	**AVE**	**CR**
FL1_CL← FL_CL	0.8926	0.5074	37.8192	0.7906	0.8830
FL2_CL← FL_CL	0.8857	0.4926	31.6667		
FL1_CS←FL_CS	0.8519	0.5277	17.5955	0.6916	0.8176
FL2_CS←FL_CS	0.8108	0.4723	6.9301		
FL1_CT←FL_CT	0.7753	0.4689	5.6966	0.6451	0.7841
FL2_CT←FL_CT	0.8301	0.5311	15.0181		
RI1_CL←RI_CL	0.7239	0.2312	14.1678	0.6823	0.8952
RI2_CL←RI_CL	0.8298	0.2171	15.6062		

Direction	Loading	Weight	T-value	AVE	CR
RI3_CL←RI_CL	0.8558	0.2581	22.3716		
RI4_CL←RI_CL	0.8854	0.2936	42.7175		
RI1_CS←RI_CS	0.7623	0.2258	17.8824	0.6860	0.8969
RI2_CS←RI_CS	0.7886	0.2406	16.8869		
RI3_CS←RI_CS	0.8708	0.2661	28.9236		
RI4_CS←RI_CS	0.8845	0.2675	40.8471		
RI1_CT←RI_CT	0.6306	0.1788	6.4761	0.5855	0.8474
RI2_CT←RI_CT	0.6933	0.2357	11.3584		
RI3_CT←RI_CT	0.8576	0.3067	31.9485		
RI4_CT←RI_CT	0.8533	0.2788	27.5349		
HM1_CL&CS←HM_CL&CS	0.8308	0.4511	12.9313	0.7405	0.8507
HM2_CL&CS←HM_CL&CS	0.8892	0.5489	29.2197		
HM1_CL&CT←HM_CL&CT	0.8397	0.4854	23.1290	0.7213	0.8381
HM2_CL&CT←HM_CL&CT	0.8588	0.5146	28.5964		
HM1_CS&CT←HM_CS&CT	0.8436	0.5072	23.5821	0.7031	0.8257
HM2_CS&CT←HM_CS&CT	0.8334	0.4928	17.7240		
TR1_CL&CS←TR_CL&CS	0.9060	0.4742	35.8595	0.8375	0.9115
TR2_CL&CS←TR_CL&CS	0.9242	0.5258	51.2835		
TR1_CL&CT←TR_CL&CT	0.8902	0.4816	29.7084	0.8067	0.8930
TR2_CL&CT←TR_CL&CT	0.9060	0.5184	46.3482		
TR1_CT&CS←TR_CT&CS	0.8581	0.4453	21.4025	0.7832	0.8784
TR2_CT&CS←TR_CT&CS	0.9111	0.5547	50.3083		
IS1_CL&CS←IS_CL&CS	0.9473	0.3499	62.8446	0.8284	0.9354
IS2_CL&CS←IS_CL&CS	0.9062	0.3350	30.9267		
IS3_CL&CS←IS_CL&CS	0.8756	0.3151	26.2282		
IS1_CL&CT←IS_CL&CT	0.8596	0.3205	17.1693	0.7050	0.8776
IS2_CL&CT←IS_CL&CT	0.8143	0.3124	11.7448		
IS3_CL&CT←IS_CL&CT	0.8444	0.3671	21.3179		
IS1_CT&CS←IS_CT&CS	0.7997	0.2897	8.0288	0.6328	0.8379
IS2_CT&CS←IS_CT&CS	0.8146	0.3347	14.5435		
IS3_CT&CS←IS_CT&CS	0.7716	0.3756	11.8363		
FM1←FM	0.7850	0.4184	8.2136	0.7088	0.8290
FM2←FM	0.8953	0.5816	35.581		
FA1←FA	0.9073	0.5556	59.6573	0.7735	0.8722
FA2←FA	0.8507	0.4444	12.9699		
SO1←SO	0.7588	0.3055	6.3896	0.6344	0.8737
SO2←SO	0.7408	0.1448	7.0731		
SO3←SO	0.8218	0.1968	10.3340		
SO4←SO	0.8590	0.3529	10.7131		
PS1←PS	0.7893	0.2355	7.1722	0.6286	0.8703
PS2←PS	0.9105	0.3555	8.2218		
PS3←PS	0.7233	0.1593	5.0479		
PS4←PS	0.7341	0.2497	5.7513		
Y1←Y1	1.0000	1	0.0000	1.0000	1.0000
Y2←Y2	1.0000	1	0.0000	1.0000	1.0000
Y31←Y3	0.8028	0.3568	8.3215	0.7676	0.8678
Y32←Y3	0.9437	0.6432	23.0442		
Z1←Z	0.8249	0.3605	15.0288	0.6575	0.8518

Direction	Loading	Weight	T-value	AVE	CR
Z2←Z	0.7577	0.2891	8.4912		
Z3←Z	0.8473	0.3504	18.2942		

Note:

a: critical t-values for a two-tailed test are 1.65 (significance level = 10 percent), 1.96 (significance level = 5 percent), and 2.58 (significance level = 1 percent);

b: algorithm setting includes use of: (i) path weighting scheme (Hair *et al.*, 2011; 2012); (ii) a uniform value of 1 as an initial value for each of the outer weights (Henseler *et al.*, 2009); and (iii) maximum number of iterations (Ringle *et al.*, 2005); and

c: the bootstrapping setting comprises: (i) use individual sign changes (Henseler *et al.*, 2009); and (ii) the number of bootstrap samples: 5000 (Hair *et al.*, 2011; 2012).

7.4.2 Evaluating hierarchical models

Table 7.7 shows that all path coefficients for the hierarchical models are significant (t value>2.56). It is worth noting that the values of R^2 are very high, indicating that the variance of second order constructs are fully explained by the first order constructs. This is because measurement items were repeated in the second order constructs (see Section 4.6.4.2) (Tenenhaus *et al.* 2005; Wetzels *et al.*, 2009). The values of Q^2 are greater than zero, indicating that the first order constructs are robust to predict the second order constructs.

Table 7.7: Evaluation of hierarchical model results

Paths	Path coefficient	T-value	R^2	Q^2
FM→PR	0.5160	7.4731	0.9997	0.5381
FA→ PR	0.6633	9.8456		
FL_CL→ FL	0.5086	9.4485	0.9999	0.4356
FL_CS→FL	0.3889	7.8032		
FL_CT→FL	0.3493	7.9887		
HM_CL&CS→HM	0.3812	6.0061	0.9999	0.4247
HM_CL&CT→HM	0.4369	8.2925		
HM_CS&CT→HM	0.4424	9.5957		
IS_CL&CS→ IS	0.5395	7.6868	0.9998	0.3594
IS_CL&CT→ IS	0.4646	6.4309		
IS_CT&CS→IS	0.3308	5.4021		
RI_CL→RI	0.4448	9.9337	0.9999	0.4087
RI_CS→RI	0.4514	12.3800		
RI_CT→RI	0.3457	9.3938		
TR_CL&CS→TR	0.4045	8.0625	0.9998	0.484
TR_CL&CT→TR	0.4338	7.8216		
TR_CT&CS→TR	0.4369	9.7200		

Note: for the blindfolding setting, the omission distance d is 7 (Hair *et al.*, 2011; 2012).

The validity of measurement and hierarchical models confirms that the constructs of network embeddedness theory, the theory Relational Contracts, relationship quality and outcomes in public project practices are correctly identified. The next step is to examine the hypothetical relationships among relational transactions (X), outcomes (Y) and relationship quality (Z).

7.4.3 Evaluating structural model and hypothesis testing

The proposed structural model to explain relational transactions (X), relationship quality (Z) and outcomes (Y) (see Figure 7.2) was validated through PLS-SEM. The results are presented in Table 7.8 and Figure 7.3. The discussion is provided in Section 7.5.

The results in Table 7.8 show that 10 path coefficients have a t-value greater than 1.65, indicating they are statistically significant at the 0.1 level. Eight hypotheses (*i.e.*, H2.4, H4.2, H5.1, H5.3, H6.3, H7.2, H9.2, and H9.3) are supported; two hypotheses (*i.e.*, H1.2 and H8.2) are not supported in the hypothesized sign.

Table 7.8: Hypothesis testing results

Code	**Path**	**Hypothesized sign**	**Beta**	**T-value**	**Inferences**
H1.1	PS→Y1	+	-0.1557	1.1317	n.s.
H1.2	PS → Y2	+	-0.2545	1.9380	not supported
H1.3	PS → Y3	+	-0.2603	1.5330	n.s.
H1.4	PS → Z	+	0.1861	1.5153	n.s.
H2.1	IS → Y1	+	-0.0551	0.4862	n.s.
H2.2	IS→Y2	+	-0.178	1.4252	n.s.
H2.3	IS→Y3	+	0.1681	1.1407	n.s.
H2.4	IS→ Z	+	0.3912	2.2443	supported
H3.1	TR→Y1	+	-0.1331	1.0023	n.s.
H3.2	TR→Y2	+	0.1487	1.0777	n.s.
H3.3	TR→Y3	+	-0.2506	1.5847	n.s.
H3.4	TR→Y4	+	-0.0302	0.2304	n.s.
H4.1	SO→Y1	+	-0.104	0.7830	n.s.
H4.2	SO→Y2	+	0.4091	2.3215	supported
H4.3	SO→Y3	+	-0.0611	0.4980	n.s.
H4.4	SO→Z	+	-0.0456	0.4266	n.s.

Code	Path	Hypothesized sign	Beta	T-value	Inferences
H5.1	PR→Y1	+	0.2943	1.7425	supported
H5.2	PR→Y2	+	-0.1092	0.9159	n.s.
H5.3	PR→Y3	+	0.5065	3.1118	supported
H5.4	PR→Z	+	-0.1949	1.4938	n.s.
H6.1	HM →Y1	+	-0.0152	0.1752	n.s.
H6.2	HM→Y2	+	-0.1033	0.8928	n.s.
H6.3	HM →Y3	+	0.2177	1.6741	supported
H6.4	HM→Z	+	0.0981	0.9312	n.s.
H7.1	FL→Y1	+	0.0103	0.1201	n.s.
H7.2	FL→Y2	+	0.2089	1.6609	supported
H7.3	FL→Y3	+	-0.086	0.9415	n.s.
H7.4	FL→Z	+	0.0023	0.0270	n.s.
H8.1	RI→Y1	+	-0.0702	0.6947	n.s.
H8.2	RI→Y2	+	-0.3126	2.6317	not supported
H8.3	RI→Y3	+	-0.0294	0.3488	n.s.
H8.4	RI→Z	+	0.1395	1.2529	n.s.
H9.1	Z→Y1	+	0.1985	1.4507	n.s.
H9.2	Z→Y2	+	0.4455	3.5348	supported
H9.3	Z→Y3	+	0.2873	2.5020	supported

Note:

a: n.s.: non-significant; not supported denotes that the hypothesis is not accepted in the hypothesized sign.

b: critical t-values for a two-tailed test are 1.65 (significance level = 10 percent), 1.96 (significance level = 5 percent), and 2.58 (significance level = 1 percent).

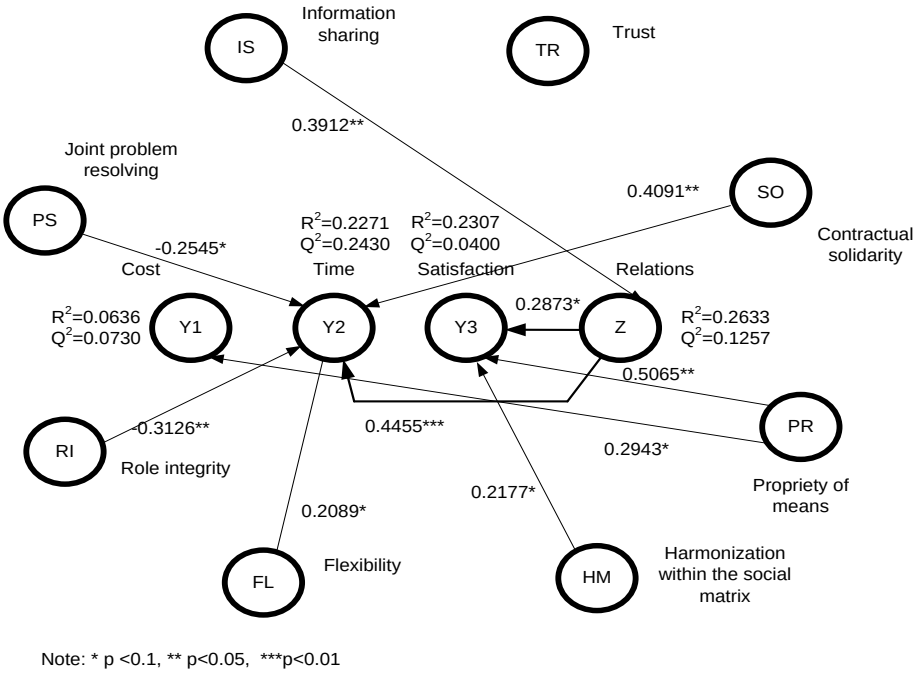


Figure 7.3: Significant paths and quality of PLS-SEM results

Objective 3 of this study is to examine whether relationship quality could give rise to

better project outcomes (see Section 1.3). The relevant hypotheses are set in Table 3.8 (see H9.1, H9.2 and H9.3). The results in Table 7.8 show that relationship quality (Z) positively influences time performance (Y_2) and satisfaction (Y_3), confirming H 9.2 and H 9.3. The discussion of this result is presented in Section 7.5.1.

The first part of objective 4 is to explore the extent to which adopting relational transaction practices can lead to better project outcomes (see Section 1.3). The relevant hypotheses are set out in Table 3.8 (see Section 3.10). The results in Table 7.8 show that: (i) propriety of means (PR) contributes to significantly better cost performance (Y_1) and satisfaction (Y_3), confirming H5.1 and H5.3; (ii) flexibility (FL) and contractual solidarity (SO) lead to better time performance (Y_2), supporting H7.2 and H4.2; and (iii) harmonization within the social matrix (HM) contributes to better satisfaction (Y_3), confirming H6.3. Three equations related to Y_1, Y_2 and Y_3 are shown below.

Figure 7.3 shows that the coefficient of the path from propriety of means (PR) to cost performance (Y_1) is significant; and the Q^2 value of 0.073 is greater than zero predictive relevance (Q^2=0.073) yet it has a low R^2 value (R^2=0.0636) (see Equation 7.1). This indicates that Equation 7.1 lacks a robustness to predict cost performance through the extent to which propriety of means is adopted in public projects, although there is a significant association between them. The measurement items of the constructs and their weights are shown in Figure 7.4.

$$Y1 = 0.2943(PR) \quad (R^2=0.0636) \qquad \text{Equation 7. 1}$$

Where:

Y1=cost performance; and

PR=propriety of means.

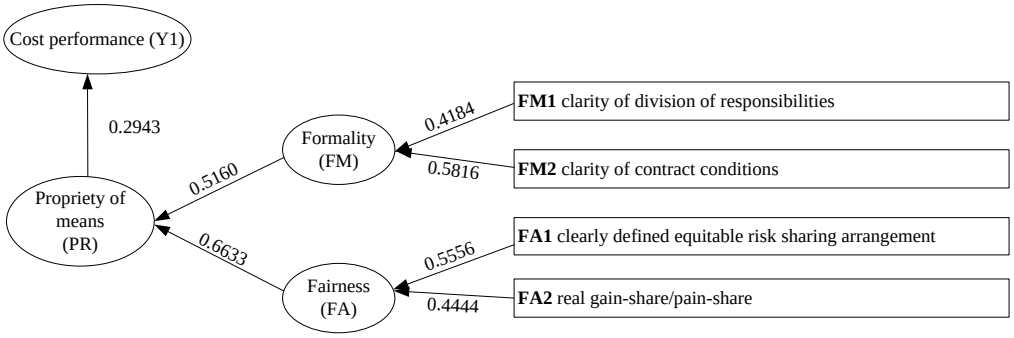


Figure 7.4: Relational transactions to achieve better cost performance

Figure 7.3 also shows that the coefficients of the path from relations (Z), contractual solidarity (SO), flexibility (FL), problem solving (PS) and role integrity (RI) to time performance (Y_2) are significant and the value of R^2 is acceptable (R^2=0.2271); and its Q^2 of 0.2430 is greater than zero (see Equation 7.2). This indicates that Equation 7.2 has an acceptable predict relevance (Tenenhuas *et al*., 2005). The measurement items of the constructs and their weights are shown in Figure 7.5.

$$Y2 = 0.4455(Z) - 0.3126(RI) + 0.4091(SO) + 0.2089(FL) - 0.2545(PS) \quad \text{Equation 7. 2}$$
(R^2=0.2271)

Where:

Y2=time performance;
RI=role integrity;
PS=problem solving;
FL=flexibility;
SO=contractual solidarity; and
Z=relationship quality.

Figure 7.3 shows that the coefficients of the paths from harmonization within the social matrix (HM), propriety of means (PR) and relations (Z) to satisfaction (Y_3) are significant, with an Q^2 value of 0.04 and an acceptable R^2 value (R^2=0.2307) (see Equation 7.3). This indicates that Equation 7.3 has an acceptable predict relevance (Tenenhuas *et al*., 2005). The measurement items of the constructs and their weights are shown in Figure 7.6.

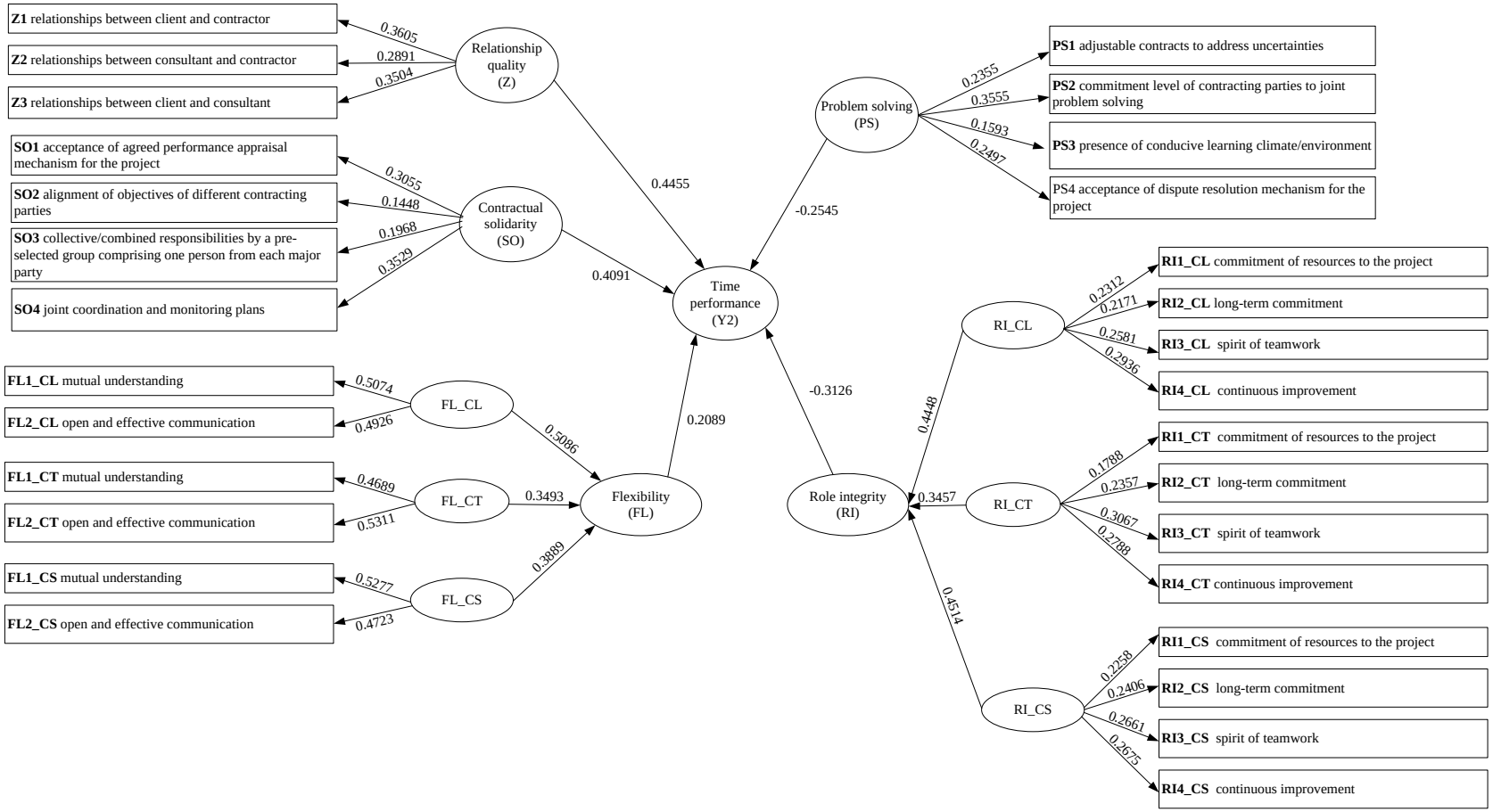


Figure 7.5: Relational transactions and relationship quality to better time performance

$$Y3 = 0.2177(HM) + 0.5065(PR) + 0.2873(Z)\ (R^2=0.2307)$$ Equation 7. 3

Where:

Y3=satisfaction;

HM=harmonization within the social matrix;

PR=propriety of means; and

Z=relationship quality.

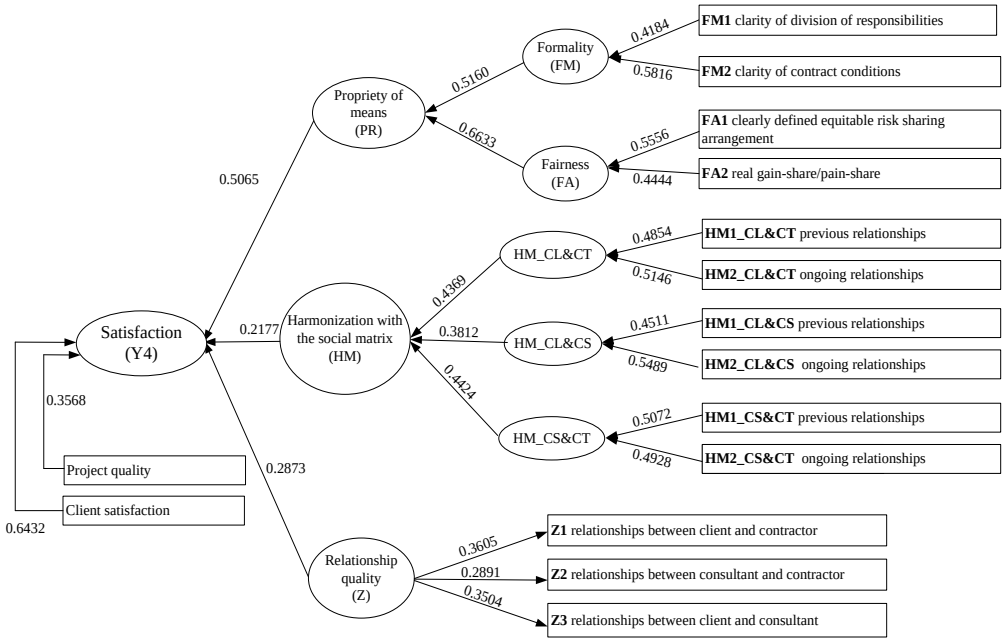


Figure 7.6: Relational transaction practices to achieve better satisfaction

The second part of objective 4 of this study is to explore the extent to which adopting relational transaction practices can lead to better relationship quality (see Section 1.3). The relevant hypotheses are set out in Table 3.8. Figure 7.7 shows that the coefficient of the path from information sharing (IS) to relations (Z) is significant, with an acceptable predictive relevance (Q^2=0.2633) and an acceptable R^2 value (R^2=0.2633). This indicates that Equation 7.4 has an acceptable predict relevance (Tenenhuas *et al*., 2005). The measurement items of the constructs and their weights are shown in Figure 7.7.

$$Z=0.3912(IS)\ (R^2=0.2633)$$ Equation 7. 4

Where:

Z=relationship quality; and

IS=Information sharing.

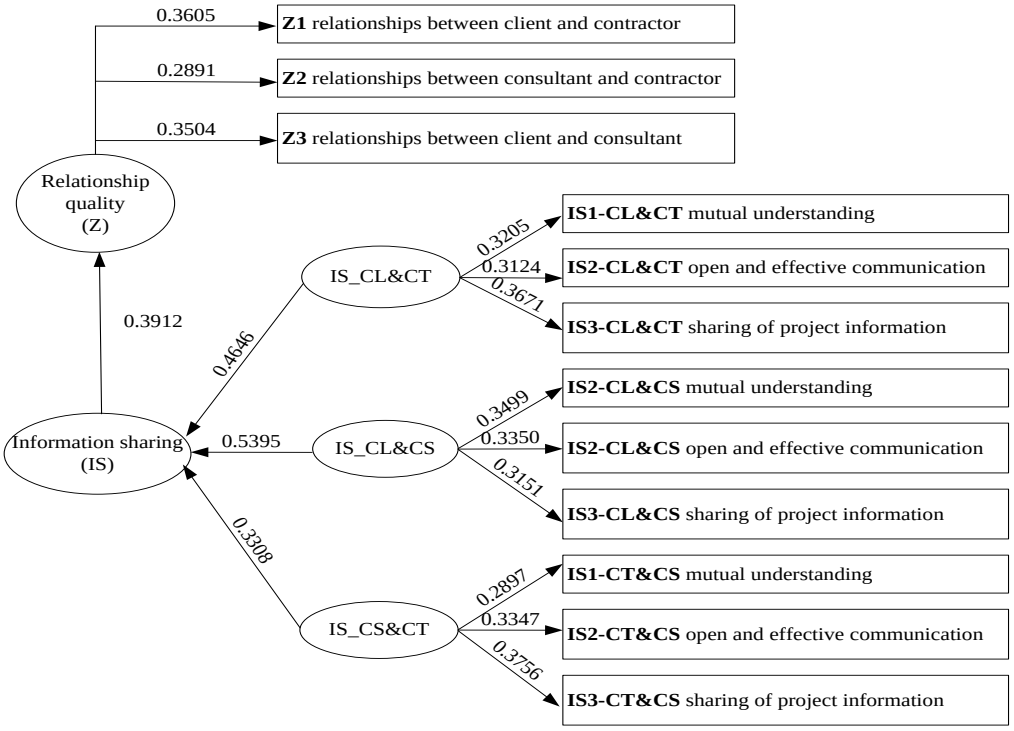


Figure 7.7: Relational transaction practices to achieve better relationship quality

7.5 Discussion

7.5.1 Improving project outcomes by nurturing relationships (Z to Y)

The results in Table 7.8 show that relationship quality (Z) positively influences time performance (Y_2) and satisfaction (Y_3) (see Section 7.4.3). Good relationships among contracting parties (Z) gives rise to a significant better time performance (Y_2) because it acts as an informal controlling tool that enables contracting parties to coordinate with each other (Jones *et al.*, 1997; Ebbers and Wijnberg, 2009) and helps them to adapt to contingencies in a timely and effective way (Powell, 1990; Uzzi, 1997; Jones *et al.*, 1997). The presence of good relationships indicates that the transaction has been embedded in the networks of contracting parties (Granovetter, 1985). The result is consistent with Uzzi (1997) who found that good relationship quality has a positive impact on time performance.

The result also shows that good relationships among contracting parties (Z) bring about better satisfaction (Y_3) (see Section 7.4.3). Parties that have good relationships

with each other have established trust and this helps to control fraud (Granovetter, 1985), encourages commitment (Uzzi, 1996), and facilitates the exchange of knowledge (Chinowsky *et al.*, 2008), leading to better project quality and client satisfaction. There is better satisfaction because close relationships can reduce the need for formal controls (Dekker and Abbeele, 2011).

7.5.2 Nurturing good relationships through relational transaction practices (X to Z)

The results in Table 7.8 show that information sharing (IS) helps to nurture relationships among the contracting parties (Z) (see Section 7.4.3). Information sharing entails having mutual understanding (IS1), open communication (IS2) and sharing project information (IS3).

To build better relationships, mutual understanding among contracting parties is vital (IS1). Each party needs to know the objectives and requirements of all the other contracting parties and how these relate to his own role. This will help parties to work well together in pursuing a common goal. A basis for mutual understanding provides an effective means to address problems as each party understands the concerns and situations faced by the other parties. Having processes in place that lead to effective problem solving and fewer conflicts contribute to the building of better relationships.

The results confirm that building close relationships requires maintaining open lines of communication (IS2) (Chen and Chen, 2007). An effective communication system plays an instrumental role in problem identification and conflict resolution (Chan *et al.*, 2004), prevents problems from becoming disputes (Wong and Cheung, 2005), assists in avoiding misunderstanding, rework and delays (Love *et al.*, 2010), enables a mutually acceptable solution to be developed (Chen and Chen, 2007), and resolves

differences efficiently and expeditiously (Wong and Cheung, 2005). These advantages serve to facilitate relationship development in the network.

The results also confirm that good relationships require timely project information sharing (IS3) (Macneil., 1986b). The provision of accurate and unbiased information helps to increase the level of mutual trust. Besides reducing uncertainties, an effective flow of project information also gives all parties an accurate update of project progress. This will enable them to collectively identify any potential problems at an early stage and further strengthen ties.

7.5.3 Enhancing project outcomes through relational transactions (X to Y)

7.5.3.1 Improving cost performance (Y_1)

The results in Table 7.8 show that propriety of means (PR) leads to better cost performance (Y_1) (see Section 7.4.3). To achieve optimal cost performance, the division of responsibilities (FM1) and the terms and conditions of the contract (FM2) should be spelt out as clearly as possible. One reason is that clear contracts promote cooperation by controlling the behaviors of individual parties and mitigate risks of the other party's opportunism (Williamson, 1985). Another reason is that contracts provide a means to coordinate the works of different contracting parties (Jap and Ganesan, 2000; Mellewigt *et al*., 2007), such as defining and aligning expectations (Woolthuis *et al.*, 2005). These help to avoid cost-related conflicts, thereby facilitating cost control.

To manage cost, the agreement should be fair (FA1 and FA2). An equitable risk-sharing arrangement (FA1) would ensure that rewards to contracting parties commensurate with their performance. In a real gain-share/pain-share arrangement (FA2), no party can make extra profits (in the long term) by shifting costs to another

party (Love *et al.*, 2010). This will motivate parties to work in a cooperative and integrative manner rather than focus on individual interests.

7.5.3.2 Facilitating time performance (Y_2)

The results in Table 7.8 indicate that flexibility (FL) and contractual solidarity (SO) lead to better time performance (Y_2) (see Section 7.4.3). On the other hand, it is surprising to find that the adoption of two practices (*i.e.*, role integrity (RI) and joint problem solving (PS)) impedes optimal time performance.

Contractual solidarity (SO) contributes significantly to better time performance (Y_2). Using the accepted performance appraisal mechanism (SO1), individual performance can be assessed against the same criteria. This enables contracting parties to accomplish objectives in a collective way and avoid potential conflicts. The alignment of objectives (SO2) also plays a role in avoiding potential time-consuming conflicts arising from individual parties pursuing only their own objectives without any regard to the overall benefits. In the face of unexpected events, common goals also present a set of guiding principles in seeking solutions, which enables problem to be resolved quickly. In addition, contracting parties working with collective responsibilities (SO3) are more likely to recognize problems in a more timely and accurate manner and thereafter take joint steps to address these problems. These approaches would help to boost efficiency and enable projects to be completed in a timely manner.

Joint coordination and planning (SO4) encourage a two-way communication among the contracting parties and helps to strengthen and preserve relationships over the course of the project. Should any conflict arise, this stability in relationships can help the different parties to resolve it more effectively, without affecting the progress of the project.

Flexibility (FL) contributes to significantly better time performance (Y_2). As all projects face unforeseen risks and changes, if contracting parties practice sufficient flexibility (FL1), they can propose quick measures to cope with contingencies and resolve problems in a timely manner. Due to the incompleteness of contracts (Baker *et al*., 2002), the attitudes of contracting parties toward coming to a compromise on any unclear issues (FL2) are important to accelerate the problem-solving process, cause fewer disputes and thereby prevent project delays.

Besides the practices leading to better time performance, the results show that role integrity (RI) and joint problem solving (PS) impede time performance (Y_2) in public projects. Commitment to team work (RI3) means more time is needed to meet and discuss in order to achieve unity in interests and opinions among team members. In addition, joint problem solving (PS2) would also take contracting parties a long time to negotiate and find and reach a unanimous resolution. Since adjustable contracts (PS1) may imply a certain level of ambiguity, it would be a time-consuming process for contracting parties to reach a consensus when making the necessary adjustments. This would likely make the situation adversarial and impedes project progress.

7.5.3.3 Enhancing satisfaction (Y_3)

The results in Table 7.8 show that two relational transaction practices – harmonization within the social matrix (HM) and propriety of means (PR) – contribute to a higher level of satisfaction (Y_3) (see Section 7.4.3). Harmonization within the social matrix (HM) helps to achieve greater satisfaction (Y_3) as previous relationships among contracting parties (HM1) can improve the level of satisfaction in the present project. One reason is that previous embedded relationships set the expectations of trust as well as bring resources into the new exchange, namely experience, knowledge access, and valuable information (Uzzi, 1996; Zahear and

Soda, 2009). The advantages from pre-existing resources facilitate quality management (Y_{31}) and help to address client requirements, leading to higher client satisfaction (Y_{32}).

In ongoing social relationships (HM2), contracting parties are already familiar with each other and this helps to avoid misunderstandings. In addition, ongoing relationships represent a social strategy for control and coordination (Eisenhardt, 1985), which can help to mitigate against opportunism. Contractors and consultants would thus provide high quality product/services to ensure the standard is acceptable, leading to higher satisfaction (Y_3).

The results also show that propriety of means (PR) leads to better satisfaction (Y_3). Clarity in the terms and conditions of a contract (FM2) helps contracting parties to kick-start the trust cycle (Wong and Cheung, 2005), which is a vital prerequisite for achieving greater satisfaction. Furthermore, clarity with regard to the responsibilities among the different parties (FM1) can help to avoid any misunderstanding of who is responsible for what and reduce conflicts in the area of quality management. The detailed duties and work scope clearly spelt out for all contracting parties would provide them with effective guidelines for quality management, leading to higher satisfaction.

Fairness in the form of clearly defined equitable risk sharing (FA1) and real gain-share/pain-share (FA2) also contribute to significantly higher satisfaction (Y_3). Contracts written with clearly defined and equitable risk allocation/sharing arrangement enable contracting parties to act collectively rather than individually. Such provisions can increase competence-based trust, leading to an increased likelihood of continued collaboration (Malhotra and Lumineau, 2011). Trust and the inclination to continue in a business relationship are credible indications of

satisfaction.

7.6 Model Validation

The model for boosting public project outcomes through relational transactions (see Figure 7.3) was validated using subject matter experts. Their views were sought on the appropriateness of statistically significant paths and the practicability of measurement models. Using purposive sampling method, eight experts who had been involved in public projects and did not participate in the first round fieldwork were targeted. The characteristics of the interviewees are shown in Table 7.9. There is a mix of contractors, consultants and public clients so that views of different parties are presented. Although more interviewees were from construction firms, the data collected would not affect the reliability of the validation exercise. This is because the unit of analysis in the validation stage was at the project level and the respondents were requested to comment on the final framework based on their observation of extent to which the relational practices were present in one public project they involved in.

The data collection instrument is a set of semi-structured questions (see Appendix 3). The questions are based on the results in Figure 7.3. The data collection method was face-to-face interviews. Each interview lasted for at least one hour. During the interview, the results of the model (see Figure 7.3) were initially introduced to the interviewee. After that, he/she was requested to comment on the appropriateness of the measurement models and the resultant structural model. The interview with CT-4 was carried out as a pilot study for the data collection instrument used at the validation stage in order to detect inadequacies in the questions.

Table 7.9: Characteristics of interview samples

Code	Designation	Experience (Years)	Type of firms	No. of interview hours
CT-1	Project director	21	Contractor	1
CT-2	Manager	20	Contractor	1
CT-3	Project manager	20	Contractor	1.5
CT-4	Site manager	5	Contractor	2
CT-5	Senior project manager	17	Contractor	1
CL-1	Senior project manager	20	Client (Infrastructure)	2
CL-2	Project director	15	Client (Housing)	1
CS-1	Project manager	25	Consultancy	1

Note: the interview with CT-4 was a pilot study.

Interviewees agreed that cost performance (Y_1), time performance (Y_2), quality performance (Y_{31}) and client satisfaction (Y_{32}) are key performance indicators of public projects. They also commented that it is reasonable to keep relationship quality (Z) separate from project outcome indicators (X). This is because good relationships are actually not a key performance indicator on public projects and no party need to account for that.

The finalized framework (see Figure 7.3) was shown to the experts and they were asked to comment on the practicability of the framework. Interviewees offered a positive assessment of the practicability of the final framework. They commented that the framework could provide them valuable insights on ways to achieve better outcomes through relational transactions in public projects. Specific comments are elaborated below.

All interviewees concurred with the finding that propriety of means (PR) has a positive influence on cost performance (Y_1). They explained that clarity of contractual terms (FM2) and responsibility (FM1) is helpful to mitigate against opportunistic behaviors and reduce potential discrepancies. These could help to avoid cost related conflicts. Interviewee CL-1 commented that:

Clients have to control the budget and cannot compromise on the cost

issue. Contractors on the other hand hope to earn larger profits. A fair way is to guard each party's interests using the agreed contractual provisions. Presence of clarity would therefore provide each party convincing justification for their behaviors.

Most interviewees agreed that fairness (FA) is helpful to achieve cost objective (Y_1). Interviewee CT-5 commented that it is still acceptable if there are minor deviations from fairness. However, interviewee CT-3 responded that the standard conditions of contract were designed by public clients and it was thus biased towards clients' interests. This bias makes it difficult for contractors to rely on the contract to guard their interests. To achieve better cost performance, it is suggested that public clients should act fairly.

Most interviewees agreed that close relationships (Z) could facilitate project progress (Y_2). Four contractor interviewees believed that good relationships accelerate their partners' responses if such relationships are based on trustworthy competency and personality of the contracting parties. Three interviewees (*i.e.*, CL-1, CL-2 and CS-1) indicated that good relationships allow for open communication and effective dissemination of tacit knowledge and implicit information. It would help to accelerate problem recognition and resolving, and thereby help to improve the time performance (Y_2).

Interviewees agreed that flexibility (FL) contributes to time performance (Y_2). Flexibility is critical to manage unforeseen situations which take place quite often in construction. Contractors who are interviewed shared that they would compromise on unclear issues (FL2). At the same time, they also hope that their partners would compensate them for their efforts.

Interviewees concurred with that contractual solidarity (SO) gives rise to better time performance (Y_2). Interviewee CL-1 commented that joint planning and monitoring (SO4) could help contracting parties to manage risks more effectively. CL-1 mentioned that:

> *Some risks are very hard to identify in advance. If unexpected risky event arises, we will come together to find a solution. This is because if we could help them, they will trust us and support us.*

Interviewees confirmed that harmonization within the social matrix (HM) positively influences the satisfaction level (Y_3). Interviewees from construction firms explained that the pre-existing working relationships (HM1) could enable them to know more about their partners' management requirements. This can help them to address partners' requirements more effectively. In addition, four contractor interviewees indicated that trust emerged from previous relationships (HM1) would speed up partners' decision making and possibly lower the frequency of site inspections.

Interviewees from the private sector indicated that previous relationships (HM1) with public clients would enable them to better understand clients' systems, like the claim process, audit procedures and the specifications. Especially some requirements are fairly subjective, like the quality of workmanships. This tacit information is rather valuable, but cannot be explicitly documented. Understanding this information would assist them in addressing clients' requirements more effectively and thereby enhance clients' satisfaction (Y_3).

Eight interviewees concurred that propriety of means (PR) could contribute to better satisfaction (Y_3). Interviewee CS-1 indicated that the clearly defined procedures could provide contracting parties an effective coordination guidance according to which contracting parties can work collectively as an integrated team. It would help to avoid misunderstanding and provide reasonable justifications when conflicts take

place.

Interviewees agreed that good relationships (Z) allow for better satisfaction (Y_3). Interviewees from the contractor side commented that close relationships could help to reduce partner's formal controls. It could also help to build a collective and flexible approach to cope with contingencies and problems. Another reason is that good relationships (Z) can lead to a higher level of commitment and encourage contracting parties to share knowledge and information, which is helpful for achieving higher level of satisfaction (Y_3). For example, contractors are likely to share the root causes of the technical problems. In addition, four contractor interviewees indicated that their partners would be likely to accept contractors' reasonable proposals if there exists trustworthy relationships. It would therefore give rise to better satisfaction.

Eight interviewees reinforced that information sharing (IS) has a positive influence on relationship quality (Z). They viewed that effective communication is helpful to resolve conflicts. Interviewees CT-1 and CS-1 noted that the method of communication is an indication of the strength of relationship quality. When contracting parties have closer relationships, they would be more approachable towards each other.

7.7 Model Application

The finalized structural model (see Figure 7.3) was validated statistically using PLS-SEM (see Section 7.4) and qualitatively through eight subject matter experts (see Section 7.6). The model is sound to be valid and robust. The next step is to transform and elaborate this model for application. Table 7.10 presents the checklists. These checklists provide contracting parties with the information of strategies to fulfill desired project outcomes and the practices to achieve these strategies.

Since the application of the checklist shares the same methodology, the explanation of how to achieve better cost performance is provided. The first application is the main strategies that help to improve cost performance. Table 7.10 shows that propriety of means (PR) has a positive impact on cost performance (Y_1). This informs contracting parties that the adoption of propriety of means is an effective way to realize the planned cost objective.

The second application deals with adopting the suggested practices to achieve strategies. Table 7.10 shows that propriety of means (PR) is positively influenced by the level of formality (FM) and fairness (FA). Four practices under propriety of means (PR) are therefore suggested. There are to: divide responsibilities among contracting parties clearly (FM1); provide clear terms and conditions in contract (FM2); share risks equitably among contracting parties (FA1); and share real gains and pain among contracting parties (FA2). This finding reminds contracting parties to prioritize these four practices when they configure propriety of means in their projects.

In order to apply the research findings to practice, some changes to current policy and practices are needed. These are presented in Table 7.10.

Table 7.10: Checklist for improving project outcomes and relationships using relational transaction practices

Desired outcome	**Strategies**	**Suggested actions**	**Changes to current policy and practice**
Improving cost performance (Y1) Improving satisfaction (Y3)	Propriety of means (PR)	Divide responsibilities among contracting parties clearly	Conduct face to face negotiation if the division of responsibility is ambiguous. Avoid outfoxing other parties to dodge responsibility.
		Provide clear terms and conditions in contract	Conduct face to face negotiation if unclear terms and conditions are spotted. Avoid a strict reference to the contract.
		Share risks equitably among contracting parties	Adopt a joint risk management approach Identify risks collectively and allocate the risks fairly
		Share real gains and pain among contracting parties	Public clients act more fairly Apply both momentary and non-monetary incentive schemes
Improving time performance (Y2)	Flexibility (FL)	Be flexible when situations change	Reduce public client's organizational bureaucracy Public clients simplify procedures to grant approvals.
		Be ready to compromise on unclear issues	Reasonably compensate partner's efforts Have an open communication before compromising on unclear issues
Improving time performance (Y2)	Contractual solidarity (SO)	Agree and accept a performance appraisal mechanism for the project	Devise a performance appraisal mechanism collectively. Monitor project progress against the agreed performance appraisal system Evaluate project performance jointly
		Align objectives of different contracting parties	Share benefits with each other fairly. Understand partner's strategic goals and project goals.
		Form a group comprising one person from each major party to have collective/combined responsibilities.	Public clients take the initiative in assembling a group comprising one person from each major party. Resolve conflicts collectively and in a timely manner.
		Coordinate and monitor plans among contracting parties jointly	Devise a project plan collectively. The project plan should: identify uncertainties; align objectives of different parties; and incorporate the joint performance appraisal system.
Improving satisfaction (Y3)	Harmonization within the social matrix (HM)	Select partners who have previous relationships among each other	Assign the staff who had prior cooperative experiences with the project partner
		Cultivate ongoing social relationships among each other	Adopt a relational, partnership and/or partnering mindset. If no prior dealings, understand partners' personalities through third parties' information.

Desired outcome	Strategies	Suggested actions	Changes to current policy and practice
Improving relationships (Z)	Information sharing (IS)	Take steps to understand each other	Understand partner's responsibilities and goals in the project. Communicate with each other to understand each other's concerns.
		Communicate openly and effectively among each other	Provide continuity by having a designated person to deal with daily communications and attend regular meetings. Make use of IT tools for communication
		Share project information among each other	Exchange project progress information in a timely manner. Shorten the path to transfer information by conducting face to face meetings. Acquire partner's informal and tacit information about managing the project through face-to-face interactions.

7.8 Summary

This chapter deals with the identification of the interrelationships among relational transactions (X), outcomes (Y) and relationship quality (Z). The descriptive analysis of relational transactions show that five practices are not implemented to a significant extent, which are related to ongoing social relationships among contracting parties (*i.e.*, HM2_CT&CS, HM2_CL&CS and HM2_CL&CT), pre-existing familiarity between contractors and consultants (HM1_CT&CS) and real gain-share/pain-share arrangement (FA2) (see Section 7.3.1).

The PLS-SEM results show that relational transactions could contribute to public project outcomes. The results in Table 7.8 show that: (i) propriety of means (PR) contributes to significantly better cost performance (Y1) and satisfaction (Y_3); (ii) flexibility (FL) and contractual solidarity (SO) lead to better time performance (Y_2); and (iii) harmonization within the social matrix (HM) contributes to better satisfaction (Y_3). The results in Table 7.8 show that relationship quality (Z) positively influences time performance (Y_2) and satisfaction (Y_3). It is also found that information sharing (IS) gives rise to better relationships (Z).

The statistical results were furthermore qualitatively validated by eight interviews (see Section 7.6). The interviewees provided positive comments on the appropriateness of the finalized model. In the end, the checklist was prepared in order to apply the findings in public projects (see Table 7.10).

Chapter 8 Conclusion and Recommendations

8.1 Summary

The construction industry has received many criticisms for the adversarial relationships that exist within it (Latham, 1994; Egan, 1998). Such relationships are likely to lead to project failure (Ng *et al.,* 2002). Past studies have found that relational transactions (*i.e.*, RC norms and network strategies) could bring about good project outcomes (*e.g.*, Chinowsky *et al.*, 2008; 2010; Taylor *et al.*, 2010; Ling and Li, 2012; Greenwood and Wu, 2012). These empirical studies, however, mainly investigated projects in general, without differentiating project types (*i.e.*, whether public or private projects). In reality, the scenario faced by contracting parties in public projects differs from that in private projects because close relationships between public officials and private contractors and consultants are frowned upon and because of the widespread practice of open and competitive tenders. Hitherto, the research on relational transactions in public projects is still piecemeal and anecdotal. This study therefore investigated the relational transaction practices that lead to better outcomes and the drivers of and barriers to relational transactions in public projects (see Section 1.3).

From the literature review, it was found that Macneil's theory of Relational Contracts (1983) and Granovetter's (1985) theory of Network Embeddedness may be used to explain transactions that take place in projects (see Sections 2.3 and 2.4). Relational transactions are underpinned by three network strategies (see Section 2.4.4) and five RC norms (see Section 2.3.3). A literature review of the practices of relational transactions in construction led to a design of the conceptual framework for boosting public project outcomes through relational transactions (see Section 3.2, Figure 3.1).

Fieldwork was undertaken to test the conceptual framework. The research design was a questionnaire-survey (see Section 4.2). A specially designed questionnaire was used to collect data from public clients, private contractors and consultants who had been involved in public projects in Singapore (see Section 4.3). A total of 104 sets of public project data were collected (see Section 5.1). After the data were collected, the one sample *t* test and EFA were used to derive the critical barriers and drivers (see Sections 6.2.1 and 6.3.1); the unpaired *t* test was applied to compare different parties' perception of the drivers and barriers (see Sections 6.2.2 and 6.3.2). PLS-SEM was used to identify the critical relational transaction practices that lead to better project outcomes and relationship quality (see Sections 7.2 to 7.5). The main statistical results were thereafter validated qualitatively by interviewing eight subject matter experts (see Section 7.6).

8.2 Key Findings, Validation of Hypotheses and Recommendations

8.2.1 Critical drivers of and barriers to relational transactions

The first objective is to identify the critical drivers of and barriers to relational transactions (see Section 1.3). It was found that the adoption of relational transactions in public projects is significantly motivated by 21 drivers (see Section 6.2.1) and deterred by 15 barriers (see Section 6.3.1). The results support hypotheses H10 and H11 (see Section 3.10) and address the third knowledge gap (see Section 3.9). It is recommended that contracting parties in public projects should pay more attention to the list of 21 drivers and 15 barriers when attempting to adopt relational transactions.

Parties are driven to adopt relational transactions if they need better value proposition, higher business competitiveness and better project time and cost performance (see Section 6.2.1). It is recommended that contracting parties in public projects identify

and make known their expectations at the start of a project, and thereafter use these to anchor relational transaction practices. Another implication is that contracting parties could embed relational transaction practices into the framework of strategic management.

From the 15 significant barriers, it can be deduced that parties are deterred from adopting relational transaction practices when they lack capabilities in relational transactions, are daunted by the ethos of public services, perceive a lack of continuity from project to project and face institutional constraints (see Section 6.3.1). It is recommended that public clients take a leading role in initiating relational transaction arrangements. They should encourage other contracting parties to organize more relational transactions related training courses or workshops. Public clients should also be pro-active in disseminating their successful relational transaction experiences to the whole construction industry.

8.2.2 Comparison of different parties' perception of drivers and barriers

The second objective is to compare different parties' perception of the drivers of and barriers to relational transactions (see Section 1.3). The results showed that the 21 drivers can significantly motivate the three parties – public clients, private consultants and contractors – to adopt relational transactions and there is no significant difference in the three groups' perception of the drivers (see Section 6.2.2). Hypotheses H12 is not supported (see Section 3.10).

Among the 23 barriers, 14, eight and three of them significantly deter public clients, private consultants and contractors respectively from adopting relational transactions (see Section 6.3.2). The results further show that contracting parties' perceptions are significantly different in face of the barriers D12, D16, D20 and D22 (see Section

6.3.2). Hence, H13 is supported (see Section 3.10). The results address the fourth knowledge gap (see Section 3.9).

It is recommended that contracting parties in public projects refer to the list of significant drivers and barriers faced by each party (see Sections 6.2.2 and 6.3.2). Practitioners could leverage the significant drivers for adopting relational transactions, especially the topmost drivers, when persuading another party to adopt relational transaction practices. In addition, each party should ensure that their relational transaction behaviors would not raise concerns among the other parties. Otherwise, the other parties would face significant barriers and stop adopting relational transactions.

Given that both public clients and private consultants encounter more constraints in adopting relational transactions than contractors, contractors should understand the differences in the various parties' perception of the barriers and ensure that their relational behaviors do not create unnecessary problems for clients and consultants. For example, they should not expect continuity from one project to another because competition through open bidding is a basic public procurement.

8.2.3 Effects of relationship quality on project outcomes

The third objective is to determine the effect of relationship quality on project outcomes (see Section 1.3). This study found that good relationships have a significantly positive influence on time performance and satisfaction (see Section 7.5.1). Hypotheses H9.2 and H9.3 are validated (see Table 7.8 and Section 7.4.3). This result can address knowledge gap one. It is recommended that contractors and consultants pay great attention to maintaining relationships with others. The frequent interaction enables them to understand other stakeholders, thereby giving good

service that leads to higher satisfaction. Good relationships enable parties to come together to solve problems, putting project goals ahead of personal goals, thereby ensuring that projects are completed in a timely manner.

8.2.4 Critical relational transaction practices leading better relationships and outcomes

The first part of the fourth objective is to identify the relational transaction practices that lead to better relationship quality. It was found that information sharing (IS) gives rise to significantly better relationships (Z) (see Section 7.5.2). This result can address the second knowledge gap (see Section 3.9) and validate the hypothesis H2.4 (see Table 7.8, Section 7.4.3). It is recommended that contracting parties establish open and effective communication channels with each other. Workshops can be conducted during the relationship formation stage so that contracting parties could get to know each other better. A web-based database could also be set up for key contracting parties to share project information.

The second part of objective four is to identify the relational transaction practices that lead to better project outcomes (see Section 1.3). The result can fill the first knowledge gap (see Section 3.9) and validate hypotheses H2.4, H4.2, H5.1, H5.3, H6.3 and H7.2 (see Section 7.4.3, Table 7.8). The findings indicate that public projects can indeed benefit from relational transactions. The main finding is that propriety of means (PR) significantly contributes to better cost performance (Y_1) and a higher level of satisfaction (Y_3) (see Sections 7.5.3.1 and 7.5.3.3). Harmonization within the social matrix (HM) leads to a significantly higher level of satisfaction (Y_3) (see Section 7.5.3.3). The implication of this finding is that the terms and conditions of public contracts should clearly define each party's responsibilities and obligations. For public projects to achieve good cost and quality outcomes, public officials should

not transfer all risks to other stakeholders or make them suffer losses. It is recommended that public clients should also design a mechanism for equitable risk sharing, and sharing of real pain and gains among contracting parties. To harmonize within the social matrix, it is recommended that contracting parties select partners who have previous relationships with then and cultivate ongoing social relationships among each other. Contracting parties should also seek more information on the way their partners go about doing things and to have a greater understanding of local customs.

Another finding is that flexibility (FL) and contractual solidarity (SO) significantly lead to better time performance (Y_2) (see Section 7.5.3.2). The implication of this finding is that contracting parties should agree on the performance appraisal method, align their objectives, implement collective responsibilities as well as plan and monitor the progress of the project collectively. It is suggested that contracting parties come to a compromise on unclear issues and be flexible when the situation changes.

8.3 Contributions to Knowledge and Practices

8.3.1 Contribution to knowledge

Prior to this study, the behaviors of contracting parties are explained by Macneil's (1978) Relational Contracts Theory. The existing literature also identified the importance of past, present and future relationships, as explained by Granovetter's (1985) Network Embeddedness Theory. This study firstly contributes to knowledge by integrating both theories into a new framework (see Figure 7.1) and testing it empirically. The newly created model (see Figure 7.3) explains the associations between RC practices and network strategies with outcomes and relationships among contracting parties in public construction projects through four mathematical equations (see Equations 7.1 to 7.4 in Section 7.4.3). The findings are important

because relational transaction practices that can contribute to better outcomes and deeper relationships in public projects are identified (see Sections 7.5.2 and 7.5.3).

The next contribution to knowledge is that this study empirically showed that relational transactions (X) do give rise to better outcomes (Y) and relationships (Z) in public projects (see Sections 7.5.2 and 7.5.3). In addition, better relationships (Z) are associated with better time performance (Y_2) and higher satisfaction (Y_3) (see Section 7.5.1). The implication is that contracting parties should not strictly adopt only formal controls but also consider relational transactions to boost project outcomes. The importance of this new knowledge is that relational transactions are not regarded as an optimal factor in public projects, but something to be embraced for better management of public projects.

Thirdly, this study contributes to knowledge by identifying the significant drivers of and barriers to relational transactions in public projects (see Sections 6.2 and 6.3). It found that the three parties – public sector clients, private sector consultants and contractors – regarded public sector accountability, bureaucracy and stringent rules, regulations and laws as the most serious barriers, which, however, are not significantly important in general projects (Kumaraswamy *et al*., 2005a).

Lastly, the study identified the significant differences in the three parties' perceptions (*i.e.*, CL, CT and CS) of the factors motivating and deterring relational transactions (see Sections 6.2.2 and 6.3.2). Specifically, it found that the three parties' perception of the drivers is not significantly different. The biggest challenge to adopting relational transactions stems from the public sector client, followed by the private sector consultants; contractors face the least number of barriers.

8.3.2 Contribution to practices

The study's first contribution to practice is to help remove the concerns that contracting parties may have with regard to adopting relational transactions in public construction projects. It showed that the implementation of relational transactions does give rise to good relationships (see Section 7.5.2) and furthermore contribute to better project outcomes (see Section 7.5.3). The findings may therefore be used to support the adoption of relational transactions in public projects.

This study's second contribution to practice is that it provided a checklist of critical relational transaction practices that could lead to better outcomes and relationship quality (see Section 7.7, Table 7.10) as well as a series of recommendations to implement these critical relational transaction practices (see Section 7.7). The checklist shows how to improve cost performance and satisfaction through formality and fairness (propriety of means). It further provided strategies of harmonization to achieve higher satisfaction. It also provided actions to be adopted to improve time performance by being flexible and having contractual solidarity. The relative importance of these practices is also provided (see Section 7.4.3, Figures 7.4 to 7.7). By making good use of the checklist and the recommendations suggested by this study, different contracting parties may be able to customize their relational transactions to achieve good project outcomes.

The study's final contribution to practice is the identification of drivers and barriers that are applicable to individual party as well all contracting parties. Recommendations to leverage the drivers and to overcome the negative impacts of the barriers were provided (see Sections 6.2 and 6.3). Contracting parties should be aware of the significant drivers as this will give them an insight into their partners' objectives in adopting relational transactions in public projects. The barriers would

enable them to understand the challenges faced by themselves and others in trying to implement relational transactions.

8.4 Limitations of the study

The first limitation is the exclusion of subcontractors and suppliers from this study. This study investigated the relational transactions of three major parties (*i.e.*, public clients, main contractors and lead consultants), without considering suppliers and subcontractors. Subcontractors and suppliers were not included because these parties do not have direct interactions with public clients. Moreover, the relationships between subcontractors and main contractors may be regarded as a transaction occurring among private parties and this have been investigated (*e.g.*, Kumaraswamy and Mattews, 2000; Zou and Lim, 2006; Unsal and Taylor, 2011). Nevertheless, it is realized that relational transactions require a holistic approach to examine all critical enveloping relations. Future studies incorporating all parties in relational transactions are thus recommended.

The second limitation concerns the possible bias towards the responses elicited from self-evaluation. Although this manner is not uncommon in the construction research domain, the results should be read with caution. Besides, answering some questions, respondents were also asked to rate the practices of their partners, for example, contractors and consultants were asked to rate the satisfaction level of their clients. The respondents may not have rated some of their answers unbiasedly. This problem may not be widespread as respondents' ratings cover a wide range and were not bundled up at certain score. Moreover, Anderson and Weitz (1992) found that one party's perception of the other party's commitment is positively related to the other's true level of commitment. Therefore, the data elicited from the assessment by other parties appears reliable.

The third limitation is in relation to the use of Likert scale. Although this method has been widely used, it is criticized that different respondents may assign different values to different points of the scale. In addition, there may be a gap between assumed knowledge and real knowledge of the respondents. This would weaken the reliability of the data gathered. To minimize this weakness, the present study used multiple measurement items to manifest one construct, which can assist in increasing the reliability of the constructs (see Section 7.4.1).

The final limitation is the use of linear statistical methods such as EFA and PLS-SEM. In reality, the patterns of relational transactions may be more complex. A high level of embeddedness, for example, would possibly constrain information sharing (Maurer and Ebers 2006) and provide the opportunity for abuse through opportunism (Granovetter, 1985), indicating that the association among relationship quality, relational transactions and project outcomes may not be linear. Future studies using nonlinear statistical methods or qualitative data to triangulate the findings are thus recommended.

8.5 Recommendations for Future Research

Several recommendations for future research are made below.

Section 8.4 indicates that the exclusion of suppliers and subcontractors. Therefore, future investigation may include both suppliers and subcontractors in the investigation.

The findings of this study added to the extant literature by showing the patterns of relational transactions in public projects only. A comparative study using the same

data instruments could be carried out to determine the similarities and difference between public and private projects in the area of relational transactions.

Despite the advantages of relational transactions, the strict rules and regulations governing public projects indicate that formal controlling tools will still be pervasive in public projects. A feasible way to advocate relational transactions is, therefore, to find a reasonable balance between relational transactions and formal controls, making it a complementary strategy in public project management. Thus, another possible future study could be done to determine the optimal combination of formal controls and relational transactions.

This study examined the drivers of and barriers to relational transactions. It is acknowledged that the drivers and barriers may be correlated with each other. Hence, future studies could examine the inter-relationships between the drivers and barriers. In addition, future studies could also quantitatively examine the extent to which the drivers and barriers affect the contracting parties' propensity to adopt relational transactions.

The impact of this study varies from country to country. A comparison study undertaken by Ling et al. (2013) preliminarily supported this argument, which found that the drivers and barriers to relational transactions are influenced by distinctive cultures in China and Australia. Therefore, the type of market structure should be borne in mind when industry professionals and the government adopt relational transactions. It is also posited that the findings of this thesis may be of relevance to construction practitioners in other geographic areas which use similar procurement procedures that are transparent and fair. Nevertheless, it is recommended to conduct a comparative study across different countries. Thus, future studies in this regard are also recommended.

Since the public sector has a strong concern of transparency in an attempt to adopt relational transactions, an examination of the relationship between the implementation of relational transactions and transparency in public projects seems imperative. Thus, future studies in this regard are recommended.

Although this study did not explicitly measure safety performance, it is realized that project safety performance is an important consideration in client's satisfaction (Y32). Nevertheless, future studies incorporating the safety performance into the project outcomes are recommended.

It is found that information sharing has a positive impact on relationship quality (see Section 8.2.4). However, this study did not examine how different type of information would influence relationships. As network embeddedness theory states that within embedded networks contracting parties would share informal and holistic information, whereas arm's length relationships only facilitate public information (Uzzi, 1997). Future studies on the impacts of different types of information on relationship quality are thus recommended.

Bibliography

Ahuja, G. (2000) The duality of collaboration: inducements and opportunities in the formation of interfirm linkages. *Strategic management Journal, 21*(3), 317-343.

Akintoye, A. and Main, J. (2007) Collaborative relationships in construction: the UK contractors' perception. *Engineering, Construction and Architectural Management, 14*(6), 597-617.

Akintoye, A., McIntosh, G. and Fitzgerald, E. (2000) A survey of supply chain collaboration and management in the UK construction industry. *European Journal of Purchasing and Supply Management, 6*(3/4), 159-168.

Albaum, G. (1997) The Likert scale revisited: an alternate version. *Journal of the Market Research Society, 39*(2), 331-348.

Allen, I.E. and Christopher, C. (2007) Likert scales and data analyses. *Quality Progress, 40*(7), 64-65.

Anderson, J.C. and Narus, J.A. (1990) A model of distributor firm and manufacturer firm working partnerships. *Journal of Marketing, 54*(1), 42-58.

Anvuur, A.M. and Kumaraswamy, M.M. (2007) Conceptual model of partnering and alliancing. *Journal of Construction Engineering and Management, 133*(3), 225-234.

Armstrong, G.D. (1980) Parametric statistics and ordinal data: a pervasive misconception. *Nursing Research, 30*(1), 60-62.

Azarian, R. (2010) Social ties: elements of a substantive conceptualization. *Acta Sociologica, 53*(4), 323-338.

Azoulay, P., Repenning, N.P. and Zuckerman, E.W. (2010) Nasty, brutish, and short: embeddedness failure in the pharmaceutical industry. *Administrative Science Quarterly, 55*(3), 472-507.

Babbie, E. (2001) *The practice of social research (9th ed.)*. London: Wadsworth/Thomson Learning.

Baccarini, D. (1999) The logical framework method for defining project success. *Project Management Journal, 30*(4), 25-32.

Badenflet, U. (2011) Fixing the contract after the contract is fixed: a study of incomplete contracts in IT and construction projects. *International Journal of Project Management, 29*(5), 568-576.

Bagozzi, R. P. and Yi, Y. (1988) On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16* (1), 74-94.

Bailey C.A. (2006) *A guide to qualitative field research (2nd ed.)*. California: Pine Forge Press.

Baker, G., Gibbons, R., and Murphy, K.J. (2002) Relational contracts and the theory of the firm. *Quarterly Journal of Economics, 117*(1), 39-84.

Bayliss, R., Cheung, S.O., Suen, H.C.H. and Wong, S.P. (2004) Effective partnering tools in construction: a case study on MTRC TKE contract 604 in Hong Kong. *International Journal of Project Management, 22*(3), 253-263.

BCA (2008) Public Sector Standard Conditions of Contract. Singapore. Retrieved 10 October, 2011 from the World Wide Web: www.bca.gov.sg.

BCA (2010) Licensing of Builders. Retrieved 10 October, 2011 from the World Wide Web: http://www.bca.gov.sg/BuildersLicensing/builders_licensing.html.

BCA (2012) Quality-Price methods framework and Quality-Fee methods framework. Retrieved 10 July, 2012 from the World Wide Web: www.bca.gov.sg.

BCA (2013a) BCA directory of registered contractors and licensed builders. Retrieved 28, January, 2013 from the World Wide Web: http://www.bcadirectory.sg/page.php?n=Overview+Details&id=MzAy

BCA (2013b) Public Sector Panels Of Consultants (PSPC). Retrieved 28, January, 2013 from the World Wide Web: http://www.bca.gov.sg/PanelsConsultants/panels_consultants.html#qfm

Beach, R. Webster, M. and Campbell, K.M. (2005) An evaluation of partnership development in the construction industry. *International Journal of Project Management, 23*(8), 611-621.

Becker, G.S. (1976) *The economic approach to human behavior*. Chicago and London: The University of Chicago Press.

Becker, G.S. and Mruphy, K.M. (1988) A theory of rational addiction. *Journal of Political Economy, 96*(4), 675-700.

Bergkvist, L. and Rossiter, J. R. (2007) The predictive validity of multiple-item versus single-item measures of the same constructs. J*ournal of Marketing Research, 44*(2), 175-184.

Bergkvist, L. and Rossiter, J. R. (2009) Tailor-made single-item measures of doubly concrete constructs. *International Journal of Advertising, 28*(4), 607-621.

Bird, R.C. (2005) Employment as a relational contract. *Journal of Labor and Employment Law, 8*(1), 149-216.

Black, C., Akintoye, A. and Fitzgerald, E. (2000) An analysis of success factors and benefits of partnering in construction. *International Journal of Project Management, 18*(6), 423-434.

Blois, K.J. (2002) Business to business exchanges: a rich descriptive apparatus derived from Macneil's and Menger's analyses. *Journal of Management Studies, 39*(4), 523-551.

Blois, K.J. and Ivens, B.S. (2007) Methods issues in the measurement of relational norms. *Journal of Business Research, 60*(5), 556-565.

Bollen, K. and Richard, L. (1991) Conventional wisdom on measurement: a structural equation perspective. *Psychological Bulletin, 110*(2), 305-314.

Borsboom, D. (2005) *Measuring the mind*. Cambridge, UK: Cambridge University Press.

Bottom, W.P., Holloway, J., Miller, G.J., Mislin, A. and Whitford, A. (2006) Building a pathway to cooperation: negotiation and social exchange between principal and agent. *Administrative Science Quarterly, 51*(1), 29-58.

Bresnen, M. and Marshall, N. (2000a) Building partnerships: case studies of client-contractor collaboration in the UK construction industry. *Construction Management and Economics, 18*(7), 819-832.

Bresnen, M. and Marshall, N. (2000b) Motivation, commitment and the use of incentives in partnerships and alliances. *Construction Management and Economics, 18*(5), 587-598.

Bresnen, M. and Marshall, N. (2000c) Partnering in construction: a critical review of issues, problems and dilemmas. *Construction Management and Economics, 18*(2), 229-237.

Brown, M., Falk, A. and Fehr, E. (2004) Relational contracts and the nature of market interactions. *Econometirca, 72*(3), 747-7780.

Brown, T.A. (2006) *Confirmatory factor analysis for applied research*. New York: Guilfor Press.

Carifio, J. and Perla, R. (2008) Resolving the 50-year debate around using and misusing Likert scales. *Medical Education, 42*(12), 1150-1152.

Castro, I., Galan, J.L. and Casanueva, C. (2009) Antecedents of construction projects coalitions: a study of the Spanish construction industry. *Construction Management and Economics, 27*(9), 809-822.

Cenfetelli, R. T. and Bassellier, G. (2009) Interpretation of formative measurement in Information systems research. *MIS Quarterly, 33*(4), 689-708.

Champbell, D. (2001) *The relational theory of contract: selected works of Ian Macneil*. London : Sweet & Maxwell

Chan, A.P.C. and Chan, A.P.L. (2004) Key performance indicators for measuring construction success. *Benchmarking: An International Journal, 11*(2), 203-221.

Chan, A.P.C., Chan, D.W.M. and Ho, K.S.K. (2003a) An empirical study of the benefits of construction partnering in Hong Kong. *Construction Management and Economics, 21*(5): 523-533.

Chan, A.P.C., Chan, D.W.M. and Ho, K.S.K. (2003b) Partnering in construction: critical study of problems for implementation. *Journal of Management in Engineering 19*(3), 126-135.

Chan, A.P.C., Chan, D.W.M., Chiang, Y.H., Tang, B.S., Chan, E.H.W. and Ho, K.S.K. (2004) Exploring critical success factors for partnering in construction Projects. *Journal of Construction Engineering and Management, 130*(2), 188-198.

Chan, A.P.C., Chan, D.W.M., Fan, L.C.N., Lam, P.T.I. and Yeung, J.F.Y. (2008) Achieving partnering success through an incentive agreement: lessons learned from an Underground Railway Extension Project in Hong Kong. *Journal of Management in Engineering, 24*(3), 128-137.

Chan, A.P.C., Ho, D.C.K. and Tam, C.M. (2001a) Design and build project success factors: multivariate analysis. *Journal of Construction Engineering and Management, 127*(2), 93-100.

Chan, A.P.C., Ho, D.C.K. and Tam, C.M. (2001b) Effect of inter-organizational teamwork on project outcome. *Journal of Management in Engineering, 17*(1), 34-38.

Chan, D.W.M. and Kumaraswamy, M.M. (1996) An evaluation of construction time performance in the building industry. *Building and Environment, 31*(6), 569-578.

Chan. A.P.C., Chan, D.W.M., Fan, L.C.N., Lam, P.T.I. and Yeung, J.F.Y. (2006) Partnering for construction excellence-a reality or myth? *Building and Environment, 41*(12), 1924-1933.

Cheatham, W. (2004) *Surety bonding joint ventures*, Construction Executive Surety Bonding, November.

Chen, C.T. and Chen, T.T. (2007) Critical success factors for construction partnering in Taiwan. *International Journal of Project Management, 25*(5), 475-484.

Cheng, E.W.L. and Li, H. (2001) Development of a conceptual model of construction partnering. *Engineering, Construction and Architectural Management, 8*(4), 292-303.

Cheng, E.W.L. and Li, H. (2002) Construction partnering process and associated critical success factors: quantitative investigation. *Journal of Management in Engineering, 18*(4), 194-202.

Cheng, E.W.L., Li, H. and Love, P. E. D. (2000) Establishment of critical success factors for construction partnering. J*ournal of Management in Engineering, 16*(2), 84-92.

Cheung, S.O., Ng, T.S.T., Wong, S.P. and Suen, H.C.H. (2003a) Behavioral aspects in construction partnering. *International Journal of Project Management, 21*(5), 333-343.

Cheung, S.O., Suen, H.C.H. and Cheung, K. (2003b) An automated partnering monitoring system - partnering temperature index. *Automation in Construction, 12*(3), 331-345.

Cheung, S.O., Yiu, T.W., Leung, A.Y.T. and Chiu, O.K. (2008) Catastrophic transitions of construction contracting behavior. *Journal of Construction Engineering and Management, 134*(12), 942-952.

Chin, W. W. and Newsted, P. R. (1999) Structural equation modelling analysis with small samples using partial least squares. In Hoyle, R. H. (Ed.), *Statistical strategies for small sample research* (pp. 307–341). Thousand Oaks, CA: Sage.

Chin, W.W. (1998) Issues and opinion on structural equation modeling. *MIS Quarterly, 22*(1): vii–xvi.

Chinowsky, P.S., Diekmann, J. and Galotti, V. (2008) Social network model of construction. *Journal of Construction Engineering and Management, 134*(10), 804-812.

Chinowsky, P.S., Diekmann, J. and O'Brien, J. (2010) Project organizations as social networks. *Journal of Construction Engineering and Management, 136*(4), 452-458.

Chowdhury, A. N., Chen, P.H. and Tiong, R.L.K. (2011) Analysing the structure of public-private partnership projects using network theory. *Construction Management and Economics, 29*(3), 247-260.

Chua, D.K.H., Kog, Y.C., Loh, P.K. and Jaselskis, E.J. (1997) Model for construction budget performance-neural network approach. *Journal of Construction Engineering and Management, 123*(3), 214-222.

Churchill, G.A. (1979) A paradigm for developing better measures for marketing constructs. *Journal of Marketing Research, 16*(1), 64-73.

Clifton, C., Young, D.M. and Duffield, C.E. (2004) Relationship contracting: finding from a study of perceptions within the Australian construction industry. *Construction Information Quarterly, 6*(4), 132-139.

Coltman, T., Devinney, T.M., Midgley, D.F. and Venaik, S. (2008) Formative versus reflective measurement models: two applications of formative measurement. *Journal of Business Research, 61*(12), 1250-1262.

Comet, C. (2009): Social capital and profits of small firms in the French construction industry. *Construction Management and Economics, 27*(4), 411-418.

Comrey, A.L. (1973) *A first course in factor analysis*. New York: Academic Press.

Construction 21 Steering Committee (1999) Re-inventing construction. Singapore: Singapore National Printers.

Conway, J.M. and Huffutt, A.I. (2003) A review and evaluation of exploratory factor analysis practices in organizational research. *Organizational Research Methods, 6*(2), 147-168.

Cook, E.L. and Hancher, D.E. (1990). Partnering: contracting for the future. *Journal of Management in Engineering, 6*(4), 431-446.

Corder, G.W. and Foreman, D.I. (2008) *Non-parametric statistics for non-statisticians: a step-by-step approach*. Hoboken, J.J.: Wiley.

Costello, A.B. and Osborne, J.W. (2005) Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment Research and Evaluation, 10*(7), 1-9.

Cox, R.F. and Issa, R.R.A. (2003) Management's perception of key performance indicators for construction. *Journal of Construction Engineering and Management, 129*(2), 142-151.

Crewell, J.W. (2009) *Research design: qualitative, quantitative, and mixed methods (3rd ed.).* Thousand Oaks, CA: Sage Publications.

Crowley, L.G. and Karim, M.A. (1995) Conceptual model of partnering. *Journal of Management in Engineering, 11*(5), 33-39.

Dacin, M.T., Ventresca, M.J. and Beal, B.D. (1999) The embeddedness of organizations: dialogue and directions. *Journal of Management, 25*(3), 317-356.

Dainty, A. R. J., Briscoe, G. H. and Millett, S. J. (2001) Subcontractor perspectives on supply chain alliances. *Construction Management and Economics, 19(8),* 841-848.

Dekker, H.C. and Abbeele, A.V. (2011) Organizational learning and inter-firm control: the effects of partner search and prior exchange experiences. *Organization Science, 21*(6), 1233-1250.

Dewulf, G. and Kadefors, A. (2012) Collaboration in public construction –contractual incentives, partnering schemes and trust. *Engineering Project Organization Journal*.

Dewulf, G. Kadefors, A. and Volker, L. (2012) Editorial: establishing collaboration in public engineering projects. *Engineering Project Organization Journal, 2*(3), 109-111.

Dhanaraj, C., Lyles, M.A. Steensma, H.K. and Tihanyi, L. (2004) Managing tacit and explicit knowledge transfer in IJVs: the role of relational embeddedness and the impact on performance. *Journal of International Business Studies, 35*(5), 428-442.

Di Vincenzo, F. and Mascia, D. (2012) Social capital in project-based organization: its role, structure, and impact on project performance. *International Journal of Project Management, 30*(1), 5-14.

Diathesopoulos, M. (2010) Relational contract theory and management contracts: A paradigm for the application of the Theory of the Norms. Lancaster University/ LLM by Research. Lancaster, UK.

Dissanayaka, S.M. and Kumaraswamy, M.M. (1999) Comparing contributors to time and cost performance in building projects. *Building and Environment, 34*(1), 31-42.

Doloi, H. (2009) Relational partnerships: the importance of communication, trust and confidence and joint risk management in achieving project success. *Construction Management and Economics, 27*(11), 1099-1109.

Drexler, J.A. and Larson, E.W. (2000) Partnering: why project owner-contractor relationships change. *Journal of Construction Engineering and Management, 126*(4), 293-297.

Dubois, A. and Gadde, L. (2000) Supply strategy and network effects-purchasing behavior in the construction industry. *European Journal of Purchasing and Supply Management, 6*(3/4), 207-215.

Dyer, J. H. (1996) Specialized supplier networks as a source of competitive advantage: evidence from the auto industry. *Strategic Management Journal, 17*(4), 271-292.

Dyer, J.H. and Nobeoka, K. (2000) Creating and managing a high-performance knowledge-sharing network: the Toyota case. *Strategic Management Journal, 21*(3), 345-367.

Dyer, J.H. and Singh, H. (1998) The relational view: cooperative strategy and sources of inter-organizational competitive advantage. *Academy of Management Review, 23*(4), 660-679.

Ebbers, J.J. and Wijnberg, N.M. (2009) Latent organizations in the film industry: contracts, rewards and resources. *Human Relations, 62*(7), 987-1009.

Eccles, R.G. (1982) The quasi-firm in the construction industry. *Journal of Economic Behavior and Organization, 2*(4), 335-357.

Economic Strategies Committee (2010) Economic Strategies Committee Key Recommendations. Singapore. Retrieved 19, November, 2011 from the World Wide Web: http://www.ecdl.org/media/Singapore%20Economic%20Committe_2010.pdf.

Edwards, J. R. (2001) Multidimensional constructs in organizational behavior research: an integrative analytical framework. *Organizational Research Methods 4*(2), 144-192.

Egan, J. (1998) *Rethinking Construction, The Report of the Construction Industry Task Force,* DETR, London.

Eisenberg, M.A. (1994) The limits of cognition and the limits of contract. *Stanford Law Review, 47*(2), 211-259.

Eisenhardt, K.M. (1985) Control: organizational and economic approaches. *Management Science, 31*(2), 134-149.

Ei-Sheikh, A. and Pryke, S.D. (2010) Network gaps and project success. *Construction Management and Economics, 28*(12), 1205-1217.

Eloranta, K. (2007) *Supplier relationship management in networked project business*. Licentiate's Thesis, Helsinki University of Technology

Eriksson, P.E. and Laan, A. (2007) Procurement effects on trust and control in client-contractor relationships. *Engineering, Construction and Architectural Management, 14*(4), 387-399.

Eriksson, P.E. and Pesämaa, O. (2007) Modelling procurement effects on cooperation. *Construction Management and Economics, 25*(8), 893-901.

Eriksson, P.E. and Westerberg, M. (2011) Effects of cooperative procurement procedures on construction project performance: a conceptual framework. *International Journal of Project Management, 29*(2), 197-208.

Eriksson, P.E., Nilsson, T. and Atkin, B. (2008) Client perceptions of barriers to partnering. *Engineering, Construction and Architectural Management, 15*(6), 527-539.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C. and Strahan, E. J. (1999) Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4(3),* 272-299.

Falk , R.F. and Miller, N.B. (1992) A primer for soft modelling. Ohio: University of Akron Press.

Feinman, J.M. (2000) Relational contract theory in context. *North-western University Law Review, 94*(3), 738-748.

Fellows, R. and Liu, A. (2003) *Research methods for construction* (2nd ed.). Malden, MA: Blackwell Science.

Field, A. (2000) *Discovering statistics using SPSS for Windows.* London: Sage

Fornell, C. and Bookstein, F. L. (1982) Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research, 19*(4), 440-452.

Fornell, C. G. and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Forrest, M and Andersen, B. (1986) Ordinal scale and statistics in medical research. *British Medical Journal, 292*(22), 537-538.

GeBIZ (2011) Guidelines for Revenue Contracting for Public Sector Agencies. Singapore. Retrieved 19, November, 2011 from the World Wide Web: http://www.gebiz.gov.sg/

Gefen, D., Straub, D. and Boudreau, M.C. (2000) Structural equation modeling and regression: guidelines for research practice. *Communications of the Association for Information Systems, 4*(7), 1-77.

Geissser, S. (1975) The predictive samples reuse method with applications. *Journal of the American Statistical Association*, 70, 320-328.

Gibb, A.G.F. and Isack, F. (2001) Client drivers for construction projects: implications for standardization. *Engineering, Construction and Architectural Management, 8(*1), 46-58.

Gibbons, R. and Henderson, R. (2012) Relational contracts and organizational capabilities. *Organization Science, 23*(5), 1350-1364.

Gittell, J.H., Seidner, R. and Wimbush, J. (2010) A relational model of how high-performance work systems work. *Organization Science, 21*(2), 490-506.

Glagola, C.R. and Sheedy, W.M. (2002) Partnering on defence contracts. *Journal of Construction Engineering and Management, 128*(2), 127-138.

Graf, R. and Perrien, J. (2005) The role of trust and satisfaction in relationship: the case of high tech firms and banks. Paper presented at the 2005 conference of the European Marketing Academy (EMAC) Munich.

Granovetter, M.S. (1973) The strength of weak ties. *The American Journal of Sociology, 78*(6), 1360-1380.

Granovetter, M.S. (1985) Economic action and social structure: the problem of embeddedness. *American Journal of Sociology, 91*(3), 481-510.

Granovetter, M.S. (1992) Economic institutions as social constructions: a framework for analysis. *Acta Sociologica, 35*(1), 3-11.

Greenwood, D. and Wu, S. (2012) Establishing the association between collaborative and construction project performance based on client and contractor perceptions. *Construction Management and Economics, 30*(4), 299-308.

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal, 38*(1), 85-112.

Gulati, R. (1998) Alliances and networks. *Strategic Management Journal, 19*(4), 293-317.

Gulati, R. (1999) Network location and learning: the influence of network resources and firm capabilities on alliance formation. *Strategic Management Journal, 20*(5), 397-420.

Gulati, R. and Gargiulo, M. (1999) Where do inter-organizational networks come from? *American Journal of Sociology, 104*(5), 1439-1493.

Gultai, R., Nohria, N. and Zaheer, A. (2000) Strategic networks. *Strategic Management Journal, 21*(3), 203-215.

Haenlein, M. and Kaplan, A.M. (2004) A beginner's guide to partial least squares analysis. *Understanding Statistics, 3*(4), 283-297.

Hagedoorn, J. (2006) Understanding the cross-level embeddedness of inter-firm partnerships formation. *Academy of Management Review, 31*(3), 670-680.

Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C. (1998) *Multivariate data analysis (4th ed.)*. Prentice Hall, Upper Saddle River, N.J.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011) PLS-SEM: indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-151.

Hair, J.F., Sarstedt, M., Ringle, C.M. and Mena, J.A. (2012) An assessment of the use of partial least squares structural equation in marketing research. *Journal of the Academy of Marketing Science, 40*(3), 414-433

Halman J.I.M. and Braks B.F.M. (1999) Project alliancing in the offshore industry. *International Journal of Project Management, 17*(2), 71-76.

Harwell, M.R. and Gatti, G.G. (2001) Rescaling ordinal data to interval data in educational research. *Review of Educational Research, 17*(1), 105-131.

Hayford, O. and Utz, C. (2002) Paying the price under project alliances. *Australia Construction Law Newsletter, 84*, 22-25.

Henseler, J., Ringle, C. M., and Sinkovics, R. R. (2009) The use of partial least squares path modeling in international marketing. *in Rudolf R. Sinkovics, Pervez N. Ghauri (ed.) New Challenges to International Marketing (Advances in International Marketing, Volume 20), Emerald Group Publishing Limited, pp.277-319.*

Henson, R.K. and Roberts, J.K. (2006) Use of exploratory factor analysis in published research: common errors and some comment on improved practice. *Educational and Psychological Measurement, 66*(3), 393-416.

Hulland, J. (1999) Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal, 20*(2), 195-204.

Humphreys, P., Matthews, F. and Kumaraswamy, M. (2003) Pre-construction project partnering: from adversarial to collaborative relationship. *Supply Chain Management: An international Journal, 8*(2), 166-178.

Jakobsson, U. (2004) Statistical presentation and analysis of ordinal data in nursing research. *Scandinavian Journal of Caring Sciences, 18*(4), 437-440.

Jap, S. D. and Ganesan, S. (2000) Control mechanisms and the relationship life cycle: implications for safeguarding specific investments and developing commitment. *Journal of Marketing Research, 37*(2), 227-245.

Jarvis, C.B., Mackenzie, S.B. and Podsakoff, P.M. (2008) A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research,* 30, 199-218.

Jin, X.H., Doloi, H. and Gao, S.Y. (2007) Relationship-based determinants of building project performance in China. *Construction Management and Economics, 25*(3), 297-304.

Jones, C., Hesterly, W.S. and Borgatti, S.P. (1997) A general theory of network governance: exchange conditions and social mechanisms, *The Academy of Management of Review, 22*(4), 911-945.

Jounes, D.S. (2002) Procurement practices in the Singapore civil service: balancing control and delegation. *Journal of Public Procurement, 2*(1), 29-53.

Kadefors, A. (2004) Trust in project relationships - inside the black box. *International Journal of Project Management, 22*(3), 175-182.

Kadefors, A., Björlingson, E. and Karlsson, A. (2007) Procuring service innovations: contractor selection for partnering projects. *International Journal of Project Management, 25*(4), 375-385.

Knapp, T.R. (1990) Treating ordinal scales as interval scales: an attempt to resolve the controversy. *Nursing Research, 39*(2), 121-123.

Konchar and Sanvido (1998) Comparison of U.S. project delivery systems. *Journal of Construction Engineering and Management, 124*(6), 435-445.

Kumaraswamy, M.M. and Matthews, J.D. (2000) Improved subcontractor selection employing partnering principles. *Journal of Management in Engineering 16*(3), 47-57.

Kumaraswamy, M.M., Ling, F.Y.Y., Rahman, M.M. and Phng, S.T. (2005a) Constructing relationally integrated teams. *Journal of Construction Engineering and Management, 131*(10), 1076-1086.

Kumaraswamy, M.M., Rahman, M.M., Ling, F.Y.Y. and Phng, S.T. (2005b) Reconstructing cultures for relational contracting. *Journal of Construction Engineering and Management, 131*(10), 1065-1075.

Laan, A. Voordijk, H. Noorderhaven, N. and Dewulf, G. (2012) Levels of inter-organizational trust in construction projects: empirical evidence. *Journal of Construction Engineering and Management, 138*(7), 821-831.

Labovitz, S. (1971) In defence of assigning numbers to ranks. *American Sociological Review, 36*(3), 521-522.

Latham, M. (1994) *Constructing the Team, Final Report on Joint Review of Procurement and Contractual Agreements in the UK Construction Industry,* HMSO, London.

Læ dre, O., Austeng, K., Haugen, T.I. and Klakegg, O.J. (2006) Procurement Routes in Public Building and Construction Projects. *Journal of Construction Engineering and Management, 132*(7), 689-696.

Lahdenperä, P. (2009) *Project alliance, the competitive single target-cost approach*. Espoo 2009. VTT Tiedotteita Research Notes, 2472-2474.

Larson, E. (1995) Project partnering: results of study of 280 construction projects. *Journal of Management in Engineering, 11*(2), 30-35.

Law, K.S. and Wong, C.S. (1990) Multidimensional constructs in structural equation analysis: an illustration using the job perception and job satisfaction. *Journal of Management, 25*(2), 143-160.

Leung, M.Y. and Chan, H.K.L. (2007) Antecedents of commitment in construction management. *Construction Management and Economics, 25*(2), 113-127.

Levin, D.Z., Walter, J. and Murnighan, J.K. (2010) Dormant ties: the value of reconnecting. *Organization Science, 22*(4), 923-939.

Li, H., Cheng, E.W.L., Love, P.E.D. and Irani, Z. (2001) Co-operative benchmarking: a tool for partnering excellence in construction. *International Journal of Project Management, 19* (3), 171-179.

Likert, R. (1932) A technique for the measurement of attitudes. *Archives of Psychology, 22*(140), 44-53.

Ling, F.Y.Y. and Kerh, S.H. (2004) Comparing the performance of design-build and design-bid-build building projects in Singapore. *Architectural Science Review, 47*(2), 163-175.

Ling, F.Y.Y., Ong, S.Y., Ke, Y., Wang, S. and Zou, P. (2013) Drivers and barriers to adopting relational contracting practices in public projects: comparative study of Beijing and Sydney. *International Journal of Project Management.*

Ling, F.Y.Y. and Tran, P.Q. (2012) Effects of interpersonal relations on public construction contracts in Vietnam. *Construction Management and Economics, 30*(12), 1087-1101.

Ling, F.Y.Y.(2004) Key determinants of performance of design-bid-build projects in Singapore. *Building Research and Information, 32*(2), 128-139.

Ling, F.Y.Y., Chan, S.L., Chong, E. and Ee, L.P. (2002) Predicting performance of design-build and design-bid-build projects. *Journal of Construction Engineering and Management, 130*(1), 75-83.

Ling, F.Y.Y., Ibbs, W. and Hoo, W.Y. (2006) Determinants of international architectural, engineering, and construction firms' project success in China. *Journal of Construction Engineering and Management*, 132(2), 206-214.

Ling, F.Y.Y., Low, S.P, Wang, S.Q. and Egbelakin, T. (2008) Models for predicting project performance in China using project management practices adopted by foreign AEC firms. *Journal of Construction Engineering and Management, 134*(12), 983-990.

Ling, F.Y.Y., Low, S.P, Wang, S.Q. and Lim, H.H. (2009) Key project management practices affecting Singaporean firms' project performance in China. *International Journal of Project Management, 27*(1), 59-71.

Ling, F.Y.Y., Rahman, M.M. and Ng, T.L. (2006) Incorporating contractual incentives to facilitate relational contracting. *Journal of Professional Issues in Engineering Education and Practice, 132*(1), 57-66.

Little, R.J.A. and Rubin, D.B. (1986) *Statistical analysis with missing data*. New York: Wiley.

Liu, A.M.M. and Fellows, R. (2001) An Eastern perspective on partnering. *Engineering, Construction and Architectural Management, 8*(1), 9-19.

Love, P.E.D., Mistry, D. and Davis, P.R. (2010) Price competitive alliance projects: identification of success factors for public clients. *Journal of Construction Engineering and Management, 136*(9), 947-956.

Lu, S.K and Yan, H. (2007) An empirical study on incentives of strategic partnering in China: views from construction companies. *International Journal of Project Management, 25*(3), 241-249.

Luu, V.T., Kim, S.Y. and Huynh, T.A. (2008) Improving project management performance of large contractors using benchmarking approach. *International Journal of Project Management, 26*(7), 758-769.

Macaulay, S. (1963) Non-contractual relations in business: a preliminary study. *American Sociological Review, 28*(1), 55-67.

Macaulay, S. (1985) An empirical view of contract. *Wisconsin Law Review*, 465-481.

Macher, J.T. and Richman, B.D. (2008) Transaction cost economics: an assessment of empirical research in the social sciences. *Business and Politics, 10*(1), 1-61.

Machina, M.J. (1987) Choice under uncertainty: problems solved and unsolved. *Economic Perspectives, 1*(1), 121-154.

MacKenzie, S.B., Podsakoff, P.M. and Podsakoff, N.P. (2011) Construct measurement and validation procedures in MIS and behavioral research: integrating new and existing techniques. *MIS Quarterly, 35*(2), 293-334.

Macneil, I.R. (1978) Contracts: adjustments of long-term economic relations under classical, neoclassical and relational contract law. *North-western University Law Review, 72(*6), 854-906.

Macneil, I.R. (1980) Power, contract, and the economic model. *Journal of Economic Issues, 14*(4), 909-923.

Macneil, I.R. (1981) Economic analysis of contractual relations: its shortfalls and the need for a rich classification apparatus. *North-western University School of Law, 75*(6), 1019-1062.

Macneil, I.R. (1983) Values in contract: internal and external. *North-western University Law Review, 78*(2), 340-347.

Macneil, I.R. (1985) Relational contract: what we do and do not know. *Wisconsin Law Review, 31*(4), 483-526.

Macneil, I.R. (1986a) Exchange revisited: individual utility and social solidarity. *The University of Chicago Press Ethics, 96*(3), 567-593.

Macneil, I.R. (2000a) Contracting worlds and essential contract theory, *Social and Legal studies, 9*(3), 431-438.

Macneil, I.R. (2000b) Relational contract theory: challenges and queries. *North-western University Law Review, 94*(3), 877-908.

Macneil, R.W. (1986b) Contract in China: law, practice, and dispute resolution. *Stanford Law Review, 38*(2), 303-397.

Malhotra, D. and Lumineau, F. (2011) Trust and collaboration in the aftermath of conflict: the effects of contract structure. *Academy of Management Journal, 54*(5), 981-998

Mariotti, F. and Delbridge, R. (2012) Overcoming network overload and redundancy in inter-organizational networks: the roles of potential and latent ties. *Organization Science, 23*(2), *511-528.*

Maurer, I. (2010) How to build trust in inter-organizational projects: The impact of project staffing and project rewards on the formation of trust, knowledge acquisition and product innovation. *International Journal of Project Management, 28*(7), 629-637.

Maurer, I. and Ebers, M. (2006) Dynamics of social capital and their performance implications: lessons from biotechnology start-ups. *Administrative Science Quarterly, 51*(2), 262-292.

Mellewigt, T. Madhok, A. and Weibel, A. (2007) Trust and formal contracts in inter-organizational relationships - substitutes and complements. *Managerial and Decision Economics, 28*(8), 833-847.

Minchin, R.E., Henriquez, N.R., King, A.M. and Lewis, D.W. (2010) Owners respond: preferences for task performance, delivery systems, and quality management. *Journal of Construction Engineering and Management, 136*(3), 283-293.

Misztal, B. (1996) *Trust in Modern Societies*. Cambridge: Polity Press.

MOF (2011) Government Procurement. Singapore. Retrieved 19, November, 2011 from the World Wide Web: http://app.mof.gov.sg/government_procurement.aspx

Molenaar, K.R. Songer, A.D. and Barash, M. (1999) Public sector design/build evolution and performance. *Journal of Management in Engineering, 15*(2), 54-62.

Moody, J. and White, D.R. (2003) Structural cohesion and embeddedness: a hierarchical concept of social groups. *American Sociological Review, 68*(1), 103-127.

Mooi, E.A. and Ghosh, M. (2010) Contract specificity and its performance implications. *Journal of Marketing, 74*(2), 105-120.

Müller, R. and Turner, R. (2007) The influence of project managers on project success criteria and project success by type of project. *European Management Journal, 25*(4) 298-309.

Netemeyer, R. G., Bearden, W. O., and Sharma, S. (2003) *Scaling procedures: issues and applications*. Thousand Oaks, CA: Sage Publications.

Neuman, W.L. (2007) *Basics of social research: qualitative and quantitative approaches*. Boston, Mass: Pearson.

Ng, S.T., Rose, T.M., Mak, M. and Eng, S. (2002) Problematic issues associated with project partnering-the contractor perspective. *International Journal of Project Management, 20*(6), 437-449.

Noor, K.B.M. (2008) Case study: a strategic research methodology. *American Journal of Applied Sciences, 5*(11), 1602-1604.

Norman, G. (2011) Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education, 15*(5), 625-632.

Nunnally, J.C. (1975) The study of change in evaluation research: principles con-concerning measurement, experimental design and analysis. In Streuning, E. L.and Guttentag, M. (Ed.) *Handbook of Evaluation Research* (pp. 101-138). Beverly Hills, CA: Sage.

Nunnally, J.C. (1978) *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

O'Brien, R.M. (1983) Rank order versus rank category measures of continuous variables. *American Sociological Review, 48*(2), 284-286.Ott, R., Longnecker, M. (2001) An Introduction to Statistical Methods and Data Analysis. Pacific Grove, Duxbury.

Packham, G., Thomas, B. and Miller, C. (2003) Partnering in the house building sector: a subcontractor's view. *International Journal of Project Management, 21*(5), 327-332.

Palaneeswaran, E. and Kumaraswamy, M.M. (2000) Benchmarking contractor selection practices in public-sector construction-a proposed model. *Engineering, Construction and Architectural Management, 7*(3), 285-299.

Pedhazur, E.J. and Schmelkin, L.P. (1991) *Measurement, design and analysis: an integrated approach*. New Jersey: Lawrence Erlaum Association.

Pennett, B.J. and Zhao Y. (1992) Confucianism, needs and organizational preferences: an examination of management trainees in China. In Williams, C. W. (Ed.), *Advances in Chinese Industrial Studies (pp. 77-93),* JAI Press: London.

Petter, S., Straub, D. and Rai, A. (2007) Specifying formative constructs in information system research. *MIS Quarterly*, *31*(4), 623-656.

Phua, F.T.T. (2006) When is construction partnering likely to happen? An empirical examination of the role of institutional norms. *Construction Management and Economics*, *24*(6): 615-624.

Powell, W.W. (1990) Neither market nor hierarchy: network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

Pryke, S.D. (2004) Analysing construction project coalitions: exploring the application of social network analysis. *Construction Management and Economics*, *22*(8), 787-797.

Puerto, C.L., Gransberg, D.D. and Shane, J.S. (2008) Comparative analysis of owner goals for design/build projects. *Journal of Management in Engineering, 24*(1), 32-39.

Radziszewska-Zielina, E. (2010) Analysis of the impact of the level of partnering relations on the selected indexes of success of polish construction enterprises. *Engineering Economics, 21*(3), 324-335

Rahman, M.M. and Kumaraswamy, M.M. (2002a) Joint risk management through transactionally efficient relational contracting. *Construction Management and Economics, 20*(1), 45-54.

Rahman, M.M. and Kumaraswamy, M.M. (2002b) Risk management trends in the construction industry: moving towards joint risk management. *Engineering, Construction and Architectural Management, 9*(2), 131-151.

Rahman, M.M. and Kumaraswamy, M.M. (2004a) Potential for implementing relational contracting and joint risk management. *Journal of Management in Engineering, 20*(4), 178-189.

Rahman, M.M. and Kumaraswamy, M.M. (2004b) Contracting relationship trends and transitions. *Journal of Management in Engineering, 20*(4), 147-161.

Rahman, M.M. and Kumaraswamy, M.M. (2005a) Assembling integrated project teams for joint risk management. *Construction Management and Economics, 23*(4), 365-375.

Rahman, M.M. and Kumaraswamy, M.M. (2005b) Relational selection for collaborative working arrangements. *Journal of Construction Engineering and Management, 131*(10), 1087-1098.

Rahman, M.M. and Kumaraswamy, M.M. (2008) Relational contracting and teambuilding: assessing potential contractual and non-contractual incentives. *Journal of Management in Engineering, 24*(1), 48-63.

Rahman, M.M. and Kumaraswamy, M.M. (2012) Multi-country perspectives of relational contracting and integrated project teams. *Journal of Construction Engineering and Management, 138*(1), 469-480.

Reinartz, W., Haenlein, M. and Henseler, J. (2009) An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing. 26*(4), 332-344.

Ringle, C. M., Götz, O., Wetzels, M. and Wilson, B. (2009) *On the use of formative measurement specifications in structural equation modeling: A Monte Carlo simulation study to compare covariance-based and partial least squares model estimation methodologies*. In METEOR Research Memoranda (RM/09/014): Maastricht University.

Ringle, C.M., Sarstede, M. and Straub, D. W. (2012) A critical look at the use of PLS-SEM in MIS quarterly. *MIS Quarterly, 36*(1), iii-xiv.

Ringle, C.M., Wende, S. and Will, A. (2005) Smart-Pls 2.0(beta). TUHH-Hamburg University of Technology.

Robson, C. (2002) *Real world research: a resource for social scientists and practitioner-researchers* (2nd ed.). Oxford: Blackwell Publisher Ltd.

Roscoe, J.T. (1975) *Fundamental research statistics for the behavioural sciences* (2nd ed.). Holt, Rinehart, and Winston, New York

Ross, J. (2003) *Introduction to project alliancing: on engineering and construction projects*. Paper presented at the Alliance Contracting Conference, Sydney.

Rowley, T., Behrens, D. and Krackhardt, D. (2000) Redundant governance structures: an analysis of structural and relational embeddedness in the steel and semiconductor industries. *Strategic Management Journal, 21*(3), 369-386.

Rowlinson, S. and Cheung, Y.K. (2005) Success factors in an alliance contract: a case study in Australia, *International Conference of AUBEA/COBRA/CIB student chapter, Queensland University of Technology*, Brisbane, Australia.

Schoder, V., Himmelmann, A. and Wilhelm, K.P. (2006) Preliminary testing for normality: some statistical aspects of a common concept. *Clinical and Experimental Dermatology, 31*(6), 757-761.

Simon, H. (1987) *Bounded rationality*. In Eatwell, J., Milgate, M. and Newman, P. (Ed.), *The new Palgrave dictionary of economics*, London, England: Macmillan.

Smyth, H. and Edkins, A. (2007) Relationship management in the management of PFI/PPP projects in the UK. *International Journal of Project Management, 25*(3), 232-240.

Songer, A.D. and Molenaar, K.R. (1997) Project characteristics for successful public-sector design-build. *Journal of Construction Engineering and Management, 123*(1), 34-40.

Starkey, K. Barnatt, C. and Tempest, S. (2000) Beyond networks and hierarchies: latent organizations in the U.K. television industry. *Organization Science, 11*(3), 299-305.

Stevens, S.S. (1968) Measurement, statistics, and the schemapiric view. *Science, 161*(3844), 849-856

Stone, M. (1974) Cross-validation choice and assessment of statistical predictions. *Journal of the Royal Statistical Society, 36*(2), 111-133.

Swan, W. and Khalfan, M.M.A. (2007) Mutual objective setting for partnering projects in the public sector. *Engineering, Construction and Architectural Management, 14*(2), 119-130.

Sydow, J. and Staber, U. (2002) The institutional embeddedness of project networks: the case of content production in German television. *Regional Studies, 36*(6), 215-227.

Sydow, J. and Windeler, A. (1998) Organizing and evaluating inter-firm networks: a structurationist perspective on network processes and effectiveness, *Organization Science, 9*(3), 265-284.

Tabachnick, B. G. and Fidell, L. S. (1996) *Using multivariate statistics* (3rd ed.). New York: HarperCollins.

Tan, W. (2008) *Practical research methods (3rd ed.)*. Singapore: Prentice Hall.

Tang, W.Z., Duffield, C.F. and Young, D.M. (2006) Partnering mechanism in construction: an empirical study on the Chinese construction industry. J*ournal of Construction Engineering and Management, 132*(3), 217-229.

Taylor, J.E., Levitt, R. and Villarroel, J.A. (2010) Simulating learning dynamics in project networks. *Journal of Construction Engineering and Management, 135*(10), 1009-1015.

Tempest, S. and Starkey, K. (2004) The effects of liminality on individual and organizational learning. *Organizations Studies, 25*(4), 507–527.

Tenenhaus, M., Vinzi, V.E. Chatelin, Y. and Lauro, C. (2005) PLS path modeling. *Computational Statistics and Data Analysis, 48*(1), 159-205.

The KPI Working Group (2000) *KPI report for the minister for construction*. Retrieved 10 May, 2011 from the World Wide Web: www.bis.gov.uk/files/file16441.pdf.

Thompson, I., Cox, A. and Anderson, L. (1998) Contracting strategies for the project environment. *European Journal of Purchasing and Supply Management, 4*(1), 31-41.

Tookey, J.E., Murray, M., Hardcastle, C. and Langford, D. (2001) Construction procurement routes: redefining the contours of construction procurement. *Engineering, Construction and Architectural Management, 8*(1), 20-30.

Tserng, H.P. and Lin, P.H. (2002) An accelerated subcontracting and procuring model for construction projects. *Automation in Construction, 11*(1), 105-125.

Turner, J.R. and Simister, S.J. (2001) Project contract management and a theory of organization. *International Journal of Project Management, 19*(8), 457-464.

Unsal,H.I. and Taylor, J.E.(2011) Modeling inter-firm dependency: game theoretic simulation to examine the holdup problem in project networks. *Journal of Construction Engineering and Management, 137*(4), 284-293.

Uzzi, B. (1996) The sources and consequences of embeddedness for the economic performance of organizations: the network effect. *American Sociological Review, 61*(4), 674-698.

Uzzi, B. (1997) Social structure and competition in inter-firm networks: the paradox of embeddedness. *Administrative Science Quarterly, 42*(1), 35-67.

Uzzi, B. (1999) Embeddedness in the making of financial capital: how social relations and networks benefit firms seeking financing. *American Sociological Review, 64*(4), 481-505.

Uzzi, B. and Gillespie, J.J. (2002) Knowledge spill-over in corporate financing networks: embeddedness and the firm's debt performance. *Strategic Management Journal, 23*(7), 595-618.

Uzzi, B. and Lancaster, R. (2003) Relational embeddedness and learning: the case of bank loan managers and their clients. *Management Science, 49*(4), 383-399.

Velleman, P.F. and Wilkinson, L. (1993) Nominal, ordinal, interval and ratio typologies are misleading. *The American Statistician, 47*(1), 65-72.

Westerveld, E. (2003) The Project Excellence Model: linking success criteria and critical success factors. *International Journal of Project Management, 21*(6), 411-418.

Weston, D.C. and Gibson, G.E. (1993) Partnering-project performance in U.S. army corps of engineers. *Journal of Management in Engineering, 9*(4), 410-425.

Wetzels, M., Odekerken-Schroder, G. and van Oppen, C. (2009) Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *MIS Quarterly, 33* (1), 177-195.

Williamson, O. E. (1991) Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly, 36*(2), 269-296.

Williamson, O.E. (1975) *Markets and hierarchies: analysis and antitrust implications.* New York: Free Press.

Williamson, O.E. (1979) Transaction-Cost Economics: the governance of contractual relations. *Journal of Law and Economics, 22*(2), 233-261.

Williamson, O.E. (1985) Asset specificity and economic organization. *International Journal of Industrial Organization, 3*(4), 365-378.

Williamson, O.E. (2000) The new institutional economics: taking stock, looking ahead. *Journal of Economic Literature, 38*(3), 595-613.

Williamson, O.E. (2003) Examining economic organization through the lens of contract. *Industrial and Corporation Change, 12*(4), 917-942.

Williamson, O.E. (2005) The economics of governance. *The American Economic Review, 95*(2), 1-18.

Winship, C. and Mare, R.D. (1984) Regression models with ordinal variables. *American Sociological Review, 49*(4), 512-525.

Wong, P.S.P., Cheung, S.O. and Ho, P.K.M. (2005) Contractor as trust initiator in construction partnering - prisoner's dilemma perspective. *Journal of Construction Engineering and Management, 131*(10), 1045-1053.

Wong, W.K., Cheung, S.O., Yiu, T.K. and Pang, H.Y. (2008) A framework for trust in construction contracting. *International Journal of Project Management, 26*(8): 821-829.

Woolthuis, R.K., Hillebrand, B. and Nooteboom, B. (2005) Trust, contract and relationship development. *Organization Studies, 26*(6), 813-840.

Xu, T., Smith, N.J. and Bower, D. A. (2005) Forms of collaboration and project delivery in Chinese construction markets: probable emergence of strategic alliances and Design/Build. *Journal of Management in Engineering, 21*(3), 100-109.

Xue, X., Shen, Q. and Ren, Z. (2010) Critical review of collaborative working in construction projects: business environment and human behaviors. *Journal of Management in Engineering, 26*(4), 196-208.

Yang, K. (2010) *Making sense of statistical methods in social research*. London: Sage.

Yeung, J.F.Y, Chan, A.P.C. and Chan, D.W.M. (2009) Developing a performance index for relationship-based construction projects in Australia: Delphi study. *Journal of Management in Engineering 25*(2): 59-68.

Zaheer, A. and Soda, G. (2009) Network evolution: the origins of structural holes. *Administrative Science Quarterly, 54*(1), 1-31.

Zhou, X., Li, Q, Zhao, W. and Cai, H. (2003) Embeddedness and contractual relationships in China's transitional economy. *American Sociological Review, 68*(1), 75-102.

Zou P.X.W., and Lim B.T.H, (2006) An empirical study in subcontractor selection and long-term alliance relationship between main-contractor and subcontractor. *International Journal of Construction Management, 6*(1), 1-13.

Zumbo, B. D. and Zimmerman, D.W. (1993) Is the selection of statistical methods governed by level of measurement? *Canadian Psychology, 34*(4), 390-400.

Appendix

Appendix-1 Cover letter

<dd/mm/yyyy>

Contact Point
Address line 2
Singapore ****

Dear Sir/Madam
SURVEY ON PRACTICES ADOPTED TO BOOST PUBLIC CONSTRUCTION PROJECT OUTCOMES

I am conducting a study on the practices adopted to boost the outcomes of public construction projects. This study involves a survey and your participation is very much needed and appreciated. Objectives of this survey include to evaluate the extent to which the relational practices were present, observed, practiced or emphasized in the project; and to assess the driving and impeding factors for adopting those practices.

It will take you about 20 minutes to complete the enclosed questionnaire. Please be assured that the findings are for academic purposes only, and your identity will never be divulged to any other party. A self-addressed and stamped envelope is enclosed for your use. We are grateful for your cooperation and hope that you will **return the completed questionnaire by <dd/mm/yyyy>**.

If you prefer to have the questionnaire completed by having me conduct a face-to-face interview with you, please contact Mr. Ning Yan at ningyan@nus.edu.sg, Mobile No. 81131931. I shall be pleased to meet you at your office, at a time that is convenient to you.

If you would like a summary of the research findings, please tick the box below and send this page to us.

I look forward to hearing from you soon. Thank you.
Yours faithfully,

Ning Yan, Mr.
Department of Building,
National University of
Singapore,
Singapore

To: Ning Yan Fax: 67755502
Department of Building,
National University of Singapore,
4 Architecture Drive, Singapore 117566

☐ Please let me have a summary of the research findings.
☐ Please contact me to fix an interview.

_____ _____ _____
(Name) (Email address) (Job title)

Appendix-2 Questionnaire

SURVEY ON PRACTICES ADOPTED TO BOOST PUBLIC CONSTRUCTION PROJECT OUTCOMES

1	Please answer the questions based on **one specific completed public construction project** which you have been involved in (eg. provision of architectural/ engineering/project management/quantity surveying (QS)/construction service or as a client).
2	**Contracting parties**: client (client's representative, public officer in charge of the project), main contractors, lead consultants.

Section A: Characteristics of the Public Project/Facility
Please answer the questions based on **one specific completed public construction project**.

1 Type of facility:
☐ Public Housing ☐ Hospital ☐ Office ☐ School ☐ Bridge ☐ Road
☐ Power Plant ☐ Water Plant ☐ Others, please specify: _____

2 Construction contract sum (approximate): S$_____million
Final construction cost (approximate): S$_____ million
OR _____ % above/below contract sum (eg. +4% means 4% above; -2% means 2% below)

3 Planned project duration:____ months; Actual project duration: ___ months

4 What role did your organization play in the development of this facility? (Select all that apply)
☐ Client ☐ Architect ☐ Engineer ☐ Main contractor ☐ Subcontractor
☐ Supplier ☐ Supervisor ☐ Others, please specify: _____

5 Which of the following best describes the client?
☐ One-off client (eg. has this project only) ☐ On-off client (eg. periodically has a new project)
☐ Ongoing client (eg. has many projects most of the time)

6 How was the main contractor selected?
☐ Open competitive bidding. Number of firms involved: _____
☐ Selective bidding. Number of firms involved: _____
☐ Negotiation. Number of firms involved: _____
☐ Others: (please specify) _____

7 In selecting main contractor, the price/non-price (e.g. technical etc.) score ratio in tender evaluation was: (eg. 20:80) _____

8 How was the main consultant (eg. architect, engineer) selected to provide the service?
☐ Open competitive bidding. Number of firms involved: _____
☐ Selective bidding. Number of firms involved: _____
☐ Negotiation. Number of firms involved: _____

☐ Government in-house consultant

☐ Others: (please specify) _____

9 In selecting main consultant, the price/non-price score ratio was: _____

10 Please rate the product/output quality of the facility/project:

☐ Very dissatisfied ☐ Dissatisfied ☐ Neutral ☐ Satisfied ☐ Very satisfied

11 Please rate the client satisfaction with the contracting parties (service quality):

☐ Very dissatisfied ☐ Dissatisfied ☐ Neutral ☐ Satisfied ☐ Very satisfied

12 What was the contractual arrangement between the main contractor and the client?

☐ Traditional design-bid-build with bills of quantities

☐ Traditional design-bid-build based on lump sum, drawings and specifications

☐ Design and build

☐ Others: (please specify, e.g Target Cost, GMP, …..) _____

13 What was the form of contract used between the client and main contractor?

☐ Public sector standard conditions of contract (PSSCOC)

☐ Singapore Institute of Architects (SIA) form of contract

☐ Joint Contracts Tribunal (JCT) form with contractors' design

☐ Others: (e.g. NEC, FIDIC, ……., please specify) _____

14	Please rate the strengths of the Relationships among contracting parties	NK=Not Known; 1=Very bad; 3=Neutral; 5=Very good					
a	Extent of relationship between client and contractor at end of project	NK	1	2	3	4	5
b	Extent of relationship between consultant and contractor at end of project	NK	1	2	3	4	5
c	Extent of relationship between client and consultant at end of project	NK	1	2	3	4	5

15	Please rate the project complexity	1=Very Low; 3=Neutral; 5=Very High				
a	Level of design complexity (eg. highly complex when designs incorporate or integrate cutting edge technology)	1	2	3	4	5
b	Level of construction complexity (eg. highly complex when building on confined site or bad soil condition)	1	2	3	4	5
c	Level of technological advancement (eg. highly complex when project involves new or emerging methods and processes, with no standard procedures to follow)	1	2	3	4	5
d	Level of specialization required of contractors or	1	2	3	4	5

	consultants					
e	Level of integration required among contracting parties	1	2	3	4	5

Section B: Practices Present, Observed, Practiced, or Emphasized in the Specific Project identified in Part A

Part B1 Practices by each contracting party

Please answer all the questions by filling in a number on a 1-5 scale, where 1=Very Low; 3=Neutral; 5=Very High.

No	Please rate the extent to which each of these were present, observed, practiced or emphasized in the project	Client	Contractor	Consultant
1	Flexibility when situations change			
2	Commitment of resources to the project			
3	Long term commitment level			
4	Team working attitude			
5	Readiness to compromise on unclear issues			
6	Attitude to continuous improvement			

Part B2 Practices between two of the contracting parties

Please answer all the questions by filling in a number on a 1-5 scale, where 1=Very Low; 3=Neutral; 5=Very High.

No	Please rate the extent to which each of these were present, observed, practiced or emphasized in the project	Client & Contractor	Client & Consultant	Contractor & Consultant
1	Familiarity/previous relationships between			
2	Mutual trust between			
3	Mutual understanding between			
4	Open and effective communication between			
5	Level of inter-personal relations/cultural harmony (individual level) between			
6	Sharing of project information between			
7	Ongoing social relationship (eg. “guanxi”, social ties and kinship outside of this project) between			

Part B3 Practices among the three main contracting parties: client, contractor, and consultant

Please answer questions by circling the appropriate number

No	Please rate the extent to which each of these were present, observed, practiced or emphasized in the project	1=Very Low; 3=Neutral; 5=Very High				
1	Clarity of division of responsibilities among contracting parties	1	2	3	4	5
2	Acceptance of performance appraisal mechanism for the project	1	2	3	4	5

No	Please rate the extent to which each of these were present, observed, practiced or emphasized in the project	1=Very Low; 3=Neutral; 5=Very High				
3	Alignment of objectives of different contracting parties	1	2	3	4	5
4	Collective/combined responsibility by a pre-selected group comprising one person from each major party	1	2	3	4	5
5	Joint coordination and monitoring plans among contracting parties	1	2	3	4	5
6	Clearly defined equitable risk sharing arrangement among contracting parties	1	2	3	4	5
7	Adjustable contracts to address uncertainties	1	2	3	4	5
8	Commitment level of contracting parties to joint problem solving	1	2	3	4	5
9	Presence of conducive learning climate/environment	1	2	3	4	5
10	Acceptance of dispute resolution mechanism for the project	1	2	3	4	5
11	Clarity of contract conditions (eg. scope of contract, duties & responsibilities)	1	2	3	4	5
12	Real gain-share/pain-share among contracting parties	1	2	3	4	5

Section C: Motives/Drivers to Adopt the relational transaction Practices

No	Please rate the motives/drivers to adopt the relational transaction practices	1=Strongly disagree; 3=Neither; 5=Strongly agree				
1	Reduce total project cost	1	2	3	4	5
2	Reduce risks and/or mitigate their influence	1	2	3	4	5
3	Reduce the cost of changing partner in projects	1	2	3	4	5
4	Reduce time in delivering the project	1	2	3	4	5
5	Reduce public client's administration burden	1	2	3	4	5
6	Improve the quality of project	1	2	3	4	5
7	Improve the design	1	2	3	4	5
8	Achieve better safety performance	1	2	3	4	5
9	Maximize resource utilization	1	2	3	4	5
10	Respond to collaborative culture in the project	1	2	3	4	5
11	Provide an integrated solution of efficiency improvement	1	2	3	4	5
12	Respond to public needs	1	2	3	4	5
13	Respond to competitors' actions (enhance competitive position)	1	2	3	4	5
14	Improve your organization's competency	1	2	3	4	5
15	Enhance your organization's reputation in the industry	1	2	3	4	5
16	Reduce disputes during the project	1	2	3	4	5

No	Please rate the motives/drivers to adopt the relational transaction practices	1=Strongly disagree; 3=Neither; 5=Strongly agree				
17	Build up closer relationship with contracting parties	1	2	3	4	5
18	Seize new market opportunities (eg. pursuing future relationships)	1	2	3	4	5
19	Achieve continuity with past/existing relationships	1	2	3	4	5
20	Respond to technology changes	1	2	3	4	5
21	Facilitate creative and innovative approaches	1	2	3	4	5

Section D: Impeding Factors to Adopt the Practices Which You Rated Low in Section B

No	Please rate the reasons/barriers to impede/prevent the practices which you rated low (1 or 2) in section B from being adopted to a larger degree.	1=Strongly disagree; 3=Neither; 5=Strongly agree				
1	Lack of knowledge of relational approaches	1	2	3	4	5
2	Lack of training and guidance in the relational arrangement	1	2	3	4	5
3	Past negative experience of relational arrangement	1	2	3	4	5
4	Misgiving about potential future relationships	1	2	3	4	5
5	Lack of experience of relational arrangement	1	2	3	4	5
6	Unenthusiastic participation of contracting parties	1	2	3	4	5
7	Lack of top management support (each party)	1	2	3	4	5
8	Lack of acceptance by contracting parties of relational approaches as a long-term way of doing business	1	2	3	4	5
9	Lack of client's initiatives in relational contracting practice	1	2	3	4	5
10	Lack of common goals among contracting parties	1	2	3	4	5
11	Inter-personal/cultural clash (individual level)	1	2	3	4	5
12	Concerns about opportunistic behavior of other contracting parties	1	2	3	4	5
13	Incompatible organizational cultures in the contracting parties	1	2	3	4	5
14	High cost to adopt relational approaches	1	2	3	4	5
15	Time required to develop relationship	1	2	3	4	5
16	Conservative industry culture inhibits changes and encourages preservation of the status quo	1	2	3	4	5
17	Lack of empowerment in the client's representatives	1	2	3	4	5
18	Lack of trust among all contracting parties	1	2	3	4	5
19	Client only has occasional need for project development	1	2	3	4	5
20	Public sector accountability concerns	1	2	3	4	5

No	Please rate the reasons/barriers to impede/prevent the practices which you rated low (1 or 2) in section B from being adopted to a larger degree.	1=Strongly disagree; 3=Neither; 5=Strongly agree				
21	Bureaucratic public client organization	1	2	3	4	5
22	Stringent public rules, regulations and laws	1	2	3	4	5
23	Need to avoid possible allegations of corruption arising from close relationships between client and other contracting parties	1	2	3	4	5

Section E: Other Suggestions and Comments on Implementing Relational Transaction Practices

_____

Section F: General Information

1 Number of years you have practiced in the construction industry: _____ years.

2 Your designation/job title: _____

3 Your organization type: (please tick where applicable)

☐ Government/statutory board/government owned enterprise/government linked enterprise

☐ Engineering firm ☐ Architectural firm ☐ Quantity surveying firm

☐ Contractor. BCA workhead: _____ Financial grade: _____

☐ Others: (please specify) _____

4 Ownership of your organization:

☐ Public ☐ Private ☐ Public-Private Joint Venture: _% public

5 Size of your organization's total workforce (approximate): _____ employees

End of the questionnaire.
Thank you for your time and effort in responding to this questionnaire.

Appendix-3 Model validation: Data collection instrument

Date:

Dear Sir/Madam

I have conducted a survey and constructed a model on boosting the outcomes of public construction projects through relational transactions.

I am now at the stage of validating the survey findings. The validation process involves an interview and your participation is very much needed and appreciated to assess the appropriateness of the model and the suggested relational practices to improve project performance.

Your feedback is valuable and appreciated.

Yours faithfully,

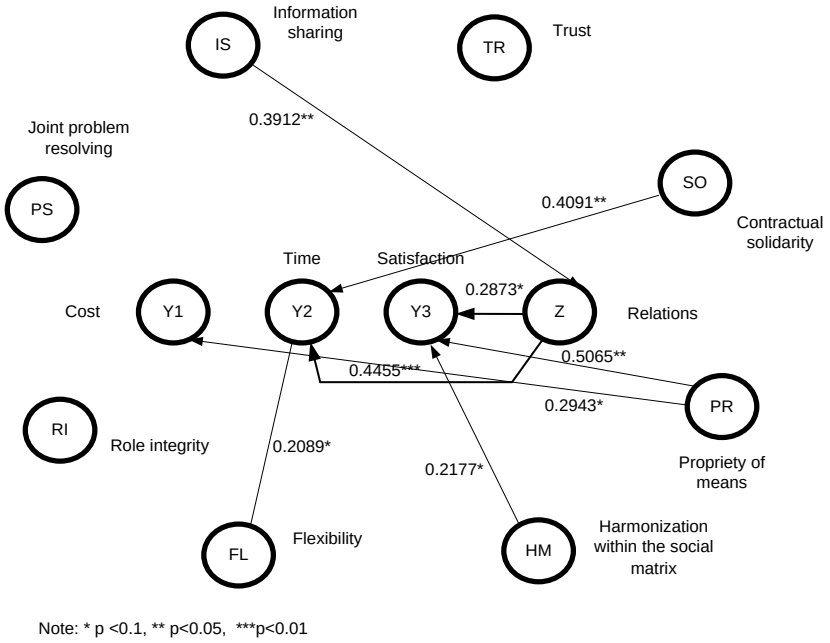
Yan Ning (Mr)
Department of Building,
National University of
Singapore,
Singapore

PRACTICES ADOPTED TO BOOST PUBLIC CONSTRUCTION PROJECT OUTCOMES

VALIDATION OF FINDINGS

Instructions: Section A and Table 1 show the survey results and suggested relational practices to boost project outcomes. Please answer the questions in Section B based on your experience in public sector projects in Singapore.

Section A:
The resultant model for boosting public project outcomes through relational transactions.



Note: * p <0.1, ** p<0.05, ***p<0.01

Table 1: Possible relational strategies to achieve better outcomes

Project outcome	Strategies	Practices
Cost performance (Y1) Satisfaction (Y3)	Propriety of means (PR)	Clarity of division of responsibilities among contracting parties
		Clarity of the terms and conditions in contract
		Clearly defined equitable risk-sharing arrangement among contracting parties
		Real gain-share/pain-share among contracting parties
Time performance (Y2)	Flexibility (FL)	Flexibility when situations change
		Readiness to compromise on unclear issues
Time performance (Y2)	Contractual solidarity (SO)	Acceptance of agreed performance appraisal mechanism for the project
		Alignment of objectives of different contracting parties
		Collective/combined responsibilities by a pre-selected group comprising one person from each major party

Project outcome	Strategies	Practices
		Joint coordination and monitoring plans among contracting parties
Satisfaction (Y3) (*i.e.*, project quality and client's satisfaction)	Harmonization within the social matrix (HM)	Previous relationships among each other
		Ongoing social relationships among each other
Relationships (Z) (*i.e.*, the relationship between client, main contractor and lead consultant)	Information sharing (IS)	Mutual understanding among each other
		Open and effective communication among each other
		Sharing of project information among each other
Time performance (Y2); Satisfaction (Y3) (*i.e.*, project quality and client's satisfaction)	Relationship quality (Z)	Relationships between clients and contractors at the end of the project
		Relationships between consultants and contractors at the end of the project
		Relationships between clients and consultants at the end of the project

Section B:
Please answer the questions in Section B based on your experience in public sector projects in Singapore. Please comment on the appropriateness of the resultant model**.**

1 Do you think time, cost, quality and client's satisfaction are sufficient to represent the key performance indicators of a public project? If not, what should be added/omitted?

2 In public projects, does propriety of means (PR) influence cost performance (Y1) and satisfaction (Y3)? Why?

3 In public projects, does flexibility (FL) influence time performance (Y3)? Why?

4 In public projects, does contractual solidarity (SO) influence time performance (Y2)? Why?

5 In public projects, does harmonization within the social matrix (HM) influence satisfaction (Y3)? Why?

6 In public projects, does information sharing (IS) influence relationship quality (Z)? Why?

7 In public projects, does relationship quality (Z) influence time performance (Y2) and satisfaction (Y3)? Why?

8 Do you agree that the relational practices listed in Table 1 would give rise to the respective project outcomes? Please go through each practice and explain the reason for your answer.

Section C: General Information

1 Number of years you have practiced in the construction industry: _____ years.

2 Your designation/job title: _____

3 Your organization type: (please tick where applicable)

☐ Government/statutory board/government owned enterprise/government linked enterprise

☐ Engineering firm ☐ Architectural firm ☐ Quantity surveying firm

☐ Contractor. ☐ Others: (please specify) _____

End of interview.
Thank you for your time and effort in participating in the interview.

Appendix-4 PLS-SEM results

Table 1: Correlation matrix and square root of AVE of constructs

	FM	FL_CL	FL_CS	FL_CT	FA	HM_CL-CS	HM_CL-CT	HM_CS-CT	IS_CL-CS	IS_CL-CT	IS_CT-CS	PS	RI_CL	RI_CS	RI_CT	SO	TR_CL-CS	TR_CL-CT	TR_CT-CS	Y1	Y2	Y3	Z
FM	**0.842**																						
FL_CL	0.273	**0.889**																					
FL_CS	0.397	0.531	**0.832**																				
FL_CT	0.159	0.469	0.335	**0.803**																			
FA	0.429	0.407	0.344	0.358	**0.879**																		
HM_CL-CS	0.207	0.076	0.353	0.149	0.274	**0.861**																	
HM_CL-CT	0.169	0.225	0.018	0.406	0.432	0.331	**0.849**																
HM_CS-CT	0.098	0.270	0.391	0.249	0.395	0.433	0.547	**0.839**															
IS_CL-CS	0.384	0.325	0.379	0.148	0.311	0.485	0.121	0.431	**0.910**														
IS_CL-CT	0.223	0.407	0.168	0.372	0.396	0.183	0.640	0.387	0.345	**0.840**													
IS_CT-CS	0.181	0.170	0.411	0.350	0.306	0.332	0.154	0.511	0.355	0.273	**0.795**												
PS	0.611	0.479	0.337	0.314	0.672	0.267	0.384	0.259	0.354	0.417	0.234	**0.793**											
RI_CL	0.442	0.550	0.294	0.197	0.464	0.246	0.350	0.277	0.496	0.538	0.131	0.543	**0.826**										
RI_CS	0.340	0.245	0.626	0.244	0.405	0.392	0.106	0.458	0.510	0.170	0.521	0.299	0.505	**0.828**									
RI_CT	0.182	0.363	0.192	0.569	0.371	0.129	0.501	0.319	0.123	0.415	0.341	0.304	0.467	0.425	**0.765**								
SO	0.642	0.334	0.382	0.254	0.640	0.368	0.425	0.379	0.376	0.437	0.285	0.679	0.523	0.477	0.434	**0.796**							
TR_CL-CS	0.421	0.221	0.354	0.108	0.310	0.556	0.219	0.418	0.872	0.330	0.317	0.382	0.488	0.477	0.158	0.424	**0.915**						
TR_CL-CT	0.186	0.311	0.050	0.372	0.425	0.130	0.782	0.522	0.259	0.742	0.289	0.408	0.376	0.136	0.536	0.425	0.313	**0.898**					
TR_CT-CS	0.277	0.194	0.365	0.219	0.350	0.250	0.339	0.703	0.445	0.300	0.647	0.226	0.267	0.478	0.345	0.320	0.422	0.523	**0.885**				
Y1	0.108	-0.001	0.046	-0.144	-0.074	-0.043	-0.016	-0.163	-0.002	-0.048	-0.207	-0.064	-0.039	-0.093	-0.071	-0.077	-0.002	-0.171	-0.092	**1.000**			
Y2	-0.137	0.053	0.041	0.086	0.063	-0.062	0.120	0.012	-0.051	0.160	-0.025	-0.042	-0.080	-0.042	0.035	0.096	0.001	0.097	0.011	0.227	**1.000**		
Y3	0.203	0.086	0.123	0.142	0.309	0.030	0.340	0.263	0.078	0.385	0.166	0.163	0.150	0.181	0.175	0.231	0.053	0.241	0.199	0.344	0.276	**0.876**	
Z	0.076	0.249	0.175	0.243	0.251	0.326	0.244	0.278	0.405	0.381	0.248	0.281	0.311	0.305	0.254	0.248	0.353	0.277	0.304	0.083	0.333	0.329	**0.811**

Note: Bolded numbers are square root of AVE

Table 2: Cross loadings for individual measurement items

	FL_ CL	FL_ CS	FL_ CT	RI_ CL	RI_ CS	RI_ CT	HM_ CL-CS	HM_ CL-CT	HM_ CS-CT	TR_ CL-CS	TR_ CL-CT	TR_ CT-CS	IS_ CL-CS	IS_ CL-CT	IS_ CT-CS	FM	FA	SO	PS	Y1	Y2	Y3	Z
FL1_CL	**0.893**	0.561	0.336	0.484	0.300	0.302	0.175	0.216	0.357	0.291	0.274	0.212	0.380	0.373	0.197	0.235	0.378	0.354	0.468	-0.020	0.069	0.078	0.253
FL2_CL	**0.886**	0.381	0.500	0.493	0.132	0.344	-0.043	0.184	0.120	0.100	0.279	0.132	0.195	0.351	0.105	0.251	0.346	0.238	0.382	0.019	0.026	0.074	0.189
FL1_CS	0.516	**0.852**	0.232	0.315	0.529	0.140	0.302	0.093	0.480	0.384	0.124	0.427	0.471	0.264	0.356	0.348	0.310	0.306	0.312	0.044	0.072	0.174	0.198
FL2_CS	0.360	**0.811**	0.331	0.167	0.513	0.182	0.286	-0.072	0.153	0.195	-0.050	0.165	0.142	0.001	0.326	0.310	0.260	0.332	0.245	0.032	-0.007	0.022	0.087
FL1_CT	0.296	0.292	**0.775**	0.123	0.213	0.484	0.261	0.331	0.205	0.052	0.197	0.150	0.022	0.259	0.378	0.101	0.317	0.212	0.281	-0.087	0.202	0.220	0.159
FL2_CT	0.449	0.250	**0.830**	0.190	0.182	0.434	-0.005	0.323	0.196	0.117	0.389	0.199	0.204	0.334	0.197	0.152	0.262	0.198	0.227	-0.142	-0.048	0.021	0.228
RI1_CL	0.427	0.247	0.166	**0.724**	0.446	0.305	0.220	0.360	0.398	0.290	0.337	0.415	0.399	0.345	0.192	0.214	0.279	0.250	0.213	-0.145	-0.152	0.042	0.267
RI2_CL	0.423	0.207	0.082	**0.830**	0.313	0.241	0.143	0.221	0.158	0.403	0.266	0.192	0.368	0.388	-0.025	0.419	0.339	0.348	0.449	-0.054	-0.090	0.012	0.094
RI3_CL	0.512	0.273	0.133	**0.856**	0.366	0.455	0.247	0.269	0.189	0.451	0.334	0.161	0.453	0.550	0.105	0.362	0.394	0.510	0.509	0.067	0.003	0.219	0.367
RI4_CL	0.452	0.244	0.247	**0.885**	0.519	0.498	0.198	0.304	0.185	0.452	0.306	0.142	0.414	0.477	0.143	0.451	0.492	0.574	0.586	-0.014	-0.043	0.188	0.277
RI1_CS	0.139	0.480	0.105	0.459	**0.762**	0.190	0.270	-0.013	0.319	0.421	0.021	0.281	0.455	0.058	0.385	0.292	0.364	0.340	0.244	-0.049	-0.224	0.182	0.184
RI2_CS	0.165	0.415	0.267	0.357	**0.789**	0.397	0.220	0.173	0.421	0.407	0.190	0.428	0.439	0.163	0.341	0.313	0.241	0.317	0.208	-0.137	-0.036	0.161	0.257
RI3_CS	0.236	0.596	0.186	0.428	**0.871**	0.411	0.357	0.036	0.377	0.349	0.087	0.416	0.384	0.115	0.506	0.270	0.329	0.462	0.270	-0.064	0.037	0.060	0.276
RI4_CS	0.260	0.572	0.245	0.432	**0.885**	0.394	0.435	0.150	0.400	0.412	0.148	0.446	0.424	0.218	0.482	0.260	0.407	0.447	0.267	-0.062	0.053	0.204	0.287
RI1_CT	0.249	0.085	0.417	0.248	0.153	**0.631**	-0.048	0.349	0.222	0.085	0.403	0.071	0.071	0.225	0.139	0.026	0.226	0.188	0.217	-0.055	-0.078	0.132	0.133
RI2_CT	0.257	0.050	0.470	0.329	0.306	**0.693**	0.076	0.415	0.308	0.156	0.369	0.361	0.160	0.281	0.183	0.189	0.247	0.224	0.174	-0.074	-0.024	0.181	0.238
R3_CT	0.298	0.248	0.454	0.453	0.418	**0.858**	0.176	0.404	0.263	0.127	0.424	0.348	0.077	0.381	0.404	0.226	0.328	0.446	0.276	-0.073	0.037	0.091	0.228
RI4_CT	0.305	0.167	0.421	0.365	0.369	**0.853**	0.131	0.378	0.196	0.116	0.458	0.228	0.078	0.355	0.262	0.084	0.319	0.408	0.259	-0.020	0.127	0.152	0.171
HM1_CL_CS	0.114	0.326	0.159	0.352	0.445	0.151	**0.831**	0.186	0.359	0.604	0.080	0.283	0.539	0.130	0.323	0.197	0.268	0.313	0.236	-0.116	-0.092	-0.122	0.321
HM2_CL_CS	0.025	0.288	0.103	0.098	0.250	0.078	**0.889**	0.368	0.386	0.378	0.138	0.160	0.320	0.181	0.256	0.163	0.210	0.321	0.226	0.028	-0.022	0.148	0.249
HM1_CL_CT	0.196	0.062	0.383	0.387	0.125	0.512	0.219	**0.840**	0.494	0.122	0.708	0.292	0.008	0.573	0.099	0.087	0.429	0.389	0.316	-0.155	0.010	0.231	0.120
HM2_CL_CT	0.187	-0.029	0.310	0.212	0.058	0.344	0.340	**0.859**	0.438	0.246	0.623	0.283	0.192	0.516	0.160	0.196	0.308	0.335	0.335	0.120	0.189	0.344	0.291
HM1_CT_CS	0.174	0.281	0.290	0.194	0.447	0.413	0.304	0.534	**0.844**	0.271	0.506	0.610	0.263	0.227	0.480	0.067	0.344	0.324	0.151	-0.181	0.052	0.214	0.211
HM2_CT_CS	0.281	0.376	0.125	0.271	0.320	0.117	0.425	0.382	**0.833**	0.432	0.367	0.569	0.462	0.424	0.376	0.097	0.319	0.312	0.284	-0.091	-0.033	0.228	0.255
TR1_CL_CS	0.238	0.292	0.121	0.528	0.478	0.162	0.502	0.196	0.376	**0.906**	0.217	0.373	0.796	0.269	0.305	0.370	0.347	0.382	0.400	-0.037	-0.010	0.114	0.346
TR2_CL_CS	0.171	0.354	0.078	0.373	0.399	0.130	0.516	0.204	0.389	**0.924**	0.349	0.399	0.800	0.331	0.277	0.400	0.226	0.394	0.305	0.030	0.011	-0.011	0.303
TR1_CL_CT	0.307	0.014	0.376	0.341	0.158	0.510	0.102	0.723	0.559	0.222	**0.890**	0.457	0.203	0.629	0.256	-0.011	0.408	0.321	0.312	-0.262	0.115	0.242	0.297
TR2_CL_CT	0.253	0.074	0.295	0.335	0.089	0.456	0.131	0.684	0.384	0.336	**0.906**	0.481	0.261	0.700	0.262	0.332	0.357	0.438	0.418	-0.052	0.060	0.192	0.203
TR1_CT_CS	0.150	0.266	0.235	0.213	0.424	0.353	0.179	0.293	0.648	0.283	0.363	**0.858**	0.304	0.146	0.572	0.084	0.251	0.160	0.131	-0.066	-0.016	0.187	0.279
TR2_CT_CS	0.190	0.370	0.161	0.256	0.424	0.269	0.256	0.307	0.605	0.448	0.545	**0.911**	0.468	0.364	0.576	0.375	0.359	0.384	0.256	-0.094	0.030	0.168	0.262
IS1_CL_CS	0.352	0.327	0.151	0.507	0.496	0.147	0.456	0.171	0.493	0.831	0.295	0.475	**0.947**	0.346	0.322	0.350	0.321	0.376	0.364	-0.014	-0.076	0.120	0.410
IS2_CL_CS	0.296	0.331	0.156	0.367	0.418	0.128	0.341	0.062	0.320	0.728	0.219	0.431	**0.906**	0.287	0.385	0.323	0.245	0.269	0.228	0.036	-0.063	0.036	0.341
IS3_CL_CS	0.233	0.380	0.093	0.479	0.480	0.057	0.533	0.093	0.357	0.823	0.189	0.300	**0.876**	0.308	0.261	0.378	0.282	0.385	0.378	-0.028	0.003	0.053	0.354
IS1_CL_CT	0.307	0.033	0.295	0.472	0.132	0.442	0.230	0.697	0.448	0.257	0.744	0.323	0.214	**0.860**	0.223	0.113	0.364	0.412	0.431	-0.060	0.125	0.325	0.446
IS2_CL_CT	0.392	0.064	0.324	0.465	0.017	0.369	-0.059	0.471	0.153	0.250	0.619	0.242	0.275	**0.814**	0.180	0.187	0.214	0.274	0.292	0.083	0.130	0.263	0.204
IS3_CL_CT	0.329	0.300	0.317	0.423	0.260	0.249	0.268	0.456	0.364	0.317	0.521	0.200	0.368	**0.844**	0.276	0.251	0.406	0.407	0.330	-0.129	0.147	0.375	0.309
IS1_CT_CS	0.086	0.303	0.250	0.108	0.404	0.239	0.483	0.191	0.522	0.187	0.180	0.579	0.188	0.154	**0.800**	0.045	0.264	0.236	0.195	-0.242	-0.096	0.031	0.236
IS2_CT_CS	0.121	0.232	0.329	0.035	0.309	0.378	0.134	0.126	0.266	0.166	0.278	0.583	0.237	0.248	**0.815**	0.139	0.184	0.231	0.086	-0.127	0.110	0.135	0.218
IS3_CT_CS	0.186	0.428	0.254	0.161	0.514	0.199	0.211	0.065	0.441	0.377	0.224	0.403	0.395	0.237	**0.772**	0.225	0.280	0.215	0.268	-0.137	-0.076	0.207	0.148

	FL_ CL	FL_ CS	FL_ CT	RI_ CL	RI_ CS	RI_ CT	HM_ CL-CS	HM_ CL-CT	HM_ CS-CT	TR_ CL-CS	TR_ CL-CT	TR_ CT-CS	IS_ CL-CS	IS_ CL-CT	IS_ CT-CS	FM	FA	SO	PS	Y1	Y2	Y3	Z
FM1	0.271	0.341	0.210	0.320	0.273	0.089	0.170	0.002	0.092	0.405	0.067	0.235	0.385	0.117	0.191	**0.785**	0.215	0.398	0.428	-0.010	-0.122	0.161	0.169
FM2	0.204	0.334	0.081	0.416	0.300	0.202	0.180	0.245	0.077	0.324	0.223	0.235	0.284	0.240	0.127	**0.895**	0.472	0.651	0.585	0.164	-0.112	0.181	-0.011
FA1	0.374	0.389	0.380	0.445	0.450	0.380	0.175	0.348	0.294	0.307	0.356	0.330	0.282	0.321	0.344	0.505	**0.907**	0.647	0.641	-0.052	0.021	0.236	0.159
FA2	0.341	0.197	0.236	0.365	0.242	0.261	0.325	0.422	0.417	0.231	0.398	0.283	0.265	0.385	0.177	0.221	**0.851**	0.462	0.534	-0.082	0.098	0.318	0.299
SO1	0.251	0.235	0.196	0.443	0.244	0.240	0.353	0.287	0.338	0.389	0.290	0.362	0.325	0.339	0.334	0.518	0.449	**0.759**	0.505	-0.037	0.124	0.157	0.259
SO2	0.207	0.337	0.231	0.410	0.406	0.215	0.304	0.317	0.219	0.367	0.262	0.109	0.342	0.353	0.162	0.592	0.519	**0.741**	0.641	-0.142	-0.114	0.141	0.088
SO3	0.370	0.420	0.182	0.405	0.450	0.389	0.226	0.369	0.372	0.220	0.386	0.238	0.245	0.315	0.145	0.465	0.495	**0.822**	0.446	-0.069	0.070	0.172	0.091
SO4	0.252	0.295	0.214	0.415	0.457	0.475	0.282	0.385	0.275	0.356	0.394	0.239	0.299	0.382	0.213	0.512	0.581	**0.859**	0.599	-0.048	0.119	0.237	0.254
PS1	0.427	0.370	0.239	0.412	0.235	0.187	0.234	0.252	0.248	0.248	0.278	0.146	0.170	0.296	0.185	0.422	0.551	0.457	**0.789**	-0.028	0.013	0.134	0.198
PS2	0.339	0.322	0.246	0.489	0.284	0.194	0.285	0.365	0.212	0.351	0.362	0.208	0.310	0.357	0.206	0.586	0.568	0.626	**0.911**	-0.086	0.020	0.209	0.285
PS3	0.398	0.256	0.261	0.402	0.326	0.337	0.072	0.263	0.212	0.409	0.372	0.299	0.348	0.329	0.317	0.559	0.550	0.572	**0.723**	-0.143	-0.077	0.048	0.117
PS4	0.410	0.119	0.272	0.417	0.134	0.318	0.193	0.317	0.167	0.244	0.306	0.105	0.321	0.353	0.087	0.391	0.497	0.511	**0.734**	0.034	-0.129	0.073	0.243
Y1	-0.001	0.046	-0.144	-0.039	-0.093	-0.071	-0.043	-0.016	-0.163	-0.002	-0.171	-0.092	-0.002	-0.048	-0.207	0.108	-0.074	-0.077	-0.064	**1.000**	0.227	0.344	0.083
Y2	0.053	0.041	0.086	-0.080	-0.042	0.035	-0.062	0.120	0.012	0.001	0.097	0.011	-0.051	0.160	-0.025	-0.137	0.063	0.096	-0.042	0.227	**1.000**	0.276	0.333
Y31	0.149	0.004	0.077	0.226	0.144	0.176	-0.079	0.225	0.171	0.035	0.225	0.193	0.082	0.346	0.145	0.232	0.173	0.127	0.146	0.365	0.091	**0.803**	0.185
Y32	0.036	0.168	0.155	0.083	0.172	0.146	0.086	0.348	0.270	0.054	0.210	0.170	0.062	0.343	0.150	0.153	0.333	0.251	0.146	0.276	0.333	**0.944**	0.355
Z1	0.205	0.045	0.109	0.277	0.111	0.280	0.087	0.278	0.182	0.148	0.310	0.206	0.193	0.442	0.037	0.033	0.144	0.209	0.206	0.112	0.309	0.391	**0.825**
Z2	0.210	0.186	0.404	0.120	0.249	0.244	0.269	0.134	0.277	0.177	0.159	0.297	0.212	0.189	0.425	0.042	0.230	0.152	0.219	-0.046	0.243	0.227	**0.758**
Z3	0.193	0.206	0.118	0.339	0.389	0.100	0.447	0.170	0.230	0.521	0.193	0.248	0.568	0.273	0.187	0.107	0.244	0.235	0.261	0.116	0.255	0.175	**0.847**